# City of Lodi
# Recycled Water Master Plan

# Final Report

**Prepared by:**

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Water and Environment

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# Chapter 6 Project Alternative Analysis

## 6.1 Introduction

The purpose of this chapter is to present the recycled water project alternatives developed and evaluated as part of this RWMP. The objective of this chapter is to identify a preferred project (or set thereof) that meets the following objectives:

- Maximize the beneficial use of highly treated recycled water in order to reduce groundwater overdraft,
- Improve water supply reliability by providing recycled water during peak demand periods, and
- Provide an interim solution for the use of the City's untreated WID water.

## 6.2 Alternatives Development

Four conceptual distribution system alternatives (A, B, C, and D) were developed based on discussions with City staff and the results of the Market Assessment conducted for this RWMP and presented in the *Conceptual Alternatives TM* (**Appendix C**). The alternatives were intentionally developed to examine transmission mains only; service laterals, which will provide recycled water to customers that are not adjacent to a transmission main, were not included. The extent of service laterals required, if necessary, will be determined during a later facility planning phase. For each alternative, potential recycled water users identified in the Market Assessment were assigned to the conceptual pipeline alignment based on proximity to the alignment. Alternatives A, B, and C include potential customers both within the City limits and near the White Slough WPCF, while Alternative D includes primarily agricultural customers near the WPCF. The methodology used to select potential users for each conceptual alternative are described in further detail in the *Conceptual Alternatives TM.*

The assumptions regarding available water supplies were based on the potential recycled water and non-potable water supplies presented in the *Recycled Water Market Assessment TM* (**Appendix B**) and the *Key Assumptions TM* (**Appendix A**).

The conceptual alternatives were each developed to provide options for delivering recycled water from the White Slough WPCF to specific potential users within the City's RWSA. Alternatives A, B, and C may use Woodbridge Irrigation District (WID) water in addition to the recycled water from the WPCF to meet customer peak irrigation demands (and reduce storage costs), while Alternative D uses recycled water from the White Slough WPCF only. Alternatives A, B, C, and D are summarized in **Table 6-1**. Maps of the conceptual alternatives are included in **Appendix C**.

**Table 6-1: Summary of Conceptual Alternatives**

| Alternative | | A | B | C | D-1 [g] | D-2 [h] |
|---|---|---|---|---|---|---|
| Customer Information | No. of schools served/total [a] | 8/19 | 12/19 | 10/19 | 0/19 | 0/19 |
| | No. of parks served/total [b] | 17/36 | 17/36 | 15/36 | 0/36 | 0/36 |
| | Acres of potential agricultural customers served [c] | 800 | 810 | 877 | 1,133 | 1,183 |
| Total Length | feet | 86,080 | 94,310 | 78,340 | 28,790 | 37,030 |
| | miles | 16.3 | 17.9 | 14.8 | 5.5 | 7.0 |
| Pipe Diameters | 6-in | 6,100 | 6,560 | 5,550 | – | – |
| | 8-in | 10,050 | 22,280 | 11,170 | – | – |
| | 12-in | 22,760 | 22,960 | 19,110 | – | 15,120 |
| | 16-in | 11,570 | 6,470 | 6,470 | 4,220 | 4,220 |
| | 24-in | 33,700 | 26,030 | 26,030 | 23,530 | 8,330 |
| | 30-in | 1,890 | 10,000 | 10,010 | 1,040 | 9,360 |
| Looped System | | Yes | Yes | No | No | Yes |
| Major Facilities | | ▪ Two pump stations<br>▪ Seasonal storage pond(s) | ▪ Two pump stations<br>▪ Seasonal storage pond(s) | ▪ Two pump stations<br>▪ Seasonal storage pond(s) | ▪ One pump station<br>▪ Seasonal storage pond(s) | ▪ One pump station<br>▪ Seasonal storage pond(s) |
| Total Demand [i] (RW Yield) | ADD [d] (mgd) | 5.2 | 5.2 | 5.2 | 3.3 | 3.3 |
| | MDD [e] (mgd) | 14.4 | 14.4 | 14.4 | 8.5 | 8.5 |
| | MHD [f] (mgd) | 19.7 | 19.7 | 19.9 | 14.5 | 14.5 |
| Interim WID Water Use | | Yes | Yes | Yes | No [j] | No [j] |

Footnotes:

a. A total of 19 schools were identified as potential recycled water customers in the *Market Assessment TM*.
b. A total of 36 parks were identified as potential recycled water customers in the *Market Assessment TM*.
c. Acreages differ among the alternatives due to 1) differing amounts of supply remaining after meeting demands from non-agricultural potential users under each alternative, and 2) the differing irrigation demands for the crop types assumed for potential agricultural users assigned to each alternative.
d. Average Day Demand.
e. Maximum Day Demand. Assumes that the *existing* NCPA facility is not operating.
f. Maximum (Peak) Hour Demand. Assumes that the *existing* NCPA facility is not operating. Represents demands from agricultural irrigation and *potential* NCPA facility, which are assumed to be supplied during the day. Urban irrigation demands, which are assumed to be supplied at night, are not included for Alternatives A, B, and C.
g. Non-looped alternative
h. Looped alternative
i. Does **NOT** include recycled water demands for water pollution control measures.
j. Interim WID water use may be feasible by diverting water from WID canals other than the South Main Canal, but doing so would require modification of the City's water supply agreement with WID.

Based on City-provided comments and feedback on the conceptual alternatives presented in the *Conceptual Alternatives TM*, two conceptual alternatives (Alternative A and the looped version of Alternative D) were selected for further refinement and evaluation. Alternatives B and C were not selected for further evaluation, due to the fact that they closely resemble Alternative A in terms of the total potential recycled water usage, but lacked several of the perceived benefits of Alternative A such as ease of constructability and lower capital costs. The non-looped version of Alternative D was not selected due the fact that it would a) feature a greater quantity of larger diameter pipes, b) require a crossing of the UPRR tracks, c) would not offer the benefits of a looped system, and d) feature an increased likelihood for the need for multiple service laterals. A regional alternative for the use of recycled water was not addressed in the *Conceptual Alternatives TM*. Instead, the City of Lodi is working with the City of Stockton to evaluate a regional alternative for the use of Lodi's available recycled water supplies in parallel with this Master Plan.

The subsequent portions of this chapter are related to Alternatives A, Alternative D, and a No Project Alternative only. The evaluation criteria for these alternatives are presented in Section 6.3.1 below.

### 6.2.1 Design Criteria

Hydraulic analyses, using $H_2O$Map Water modeling software, were performed to determine the estimated sizes for the backbone pipelines, pump stations, and storage facilities required to provide recycled water to the service area for the project alternatives evaluated. The hydraulic criteria shown in **Table 6-2** were used as a basis for these analyses.

Users that are not adjacent to the backbone pipeline system will receive recycled water from service laterals. The hydraulic analyses performed for this RWMP did not include the development of service laterals. The anticipated length, sizes, and costs for service laterals are reflected in the estimated costs for the preferred project (Chapter 7).

**Table 6-2: Design Criteria**

| Criteria | Value | Unit |
|---|---|---|
| Design velocity range | 2-10 | feet per second (fps) |
| Minimum delivery pressure [a] | 80 | psi |
| Maximum system pressure | 150 | psi |
| Minimum pipe size | 6 | inches |
| Available pipe sizes | 6, 8, 10, 12, 16, 24, 30 | inches |
| Maximum head loss [b] | 7 | feet per 1,000 feet of pipe |
| Minor head loss | 5 | % of velocity headloss |

Footnotes:

a. During peak hour demand conditions, and measured at the transmission main. Although significantly higher than the City's potable water system, a higher pressure requirement has been assumed for irrigation systems, based on discussions with City Parks Department.

b. Head loss calculated using Hazen-Williams equation, with C = 130.

Additionally, the following criteria and assumptions were developed for pump stations and seasonal storage facilities.

#### Pump Stations

Pump stations must be capable of pumping a range of flows based on varying demand. The following design criteria were used to establish planning level pump station facilities and cost estimates:

- Construction on City property

- Size for peak hour demands
- Install variable frequency drives (VFDs)
- No back-up power supply
- One standby pump
- Minimum pump efficiency of 75%
- At least 2 pumps should be the same size

## Seasonal Storage Options

As discussed in Section 4.2, the City is currently examining the possibility of using additional treated municipal effluent (recycled water) for the dilution and blending of cannery flows and biosolids in the vicinity of the White Slough WPCF. According to a memorandum titled *TM No. 2: Land Application: Future Nitrogen Loading Conditions* (Appendix H), 892 MG of the City's municipal effluent will be required for this purpose in the future. Although it is unknown at this time whether the amount of effluent required will in fact be used by the City, the potential reduction in available treated effluent supply has been treated as a demand for the purposes of this RWMP (referred to henceforth as "on-site" recycled water demand). Under this assumption, the City would be significantly constrained in any attempt to serve recycled water to customers elsewhere in the RWSA (i.e., "off-site" demand) unless seasonal storage is utilized. After discussions with City staff, RMC recommends the following two seasonal storage options be considered:

- **Seasonal Storage for On- and Off-Site Demands:** Recycled water from the White Slough WPCF would be seasonally stored in order to meet both on-site *and* off-site recycled water demands. Storage ponds would be filled with recycled water during months when recycled water demand is low or absent (e.g., January), and would be drawn from the ponds throughout the growing season, when both on-site and off-site demands are at their peak. The storage ponds would be sized such that the ponds would be empty or nearly empty at the end of the growing season. Under this alternative, supplemental sources of water would be unnecessary to meet peak demands in the off-site recycled water system.
- **Seasonal Storage for On-Site Demands:** Recycled water would be seasonally stored in order to meet on-site recycled water demands *only*, resulting in a smaller total storage volume than that required for both on- and off-site demands. The storage ponds would be filled with recycled water during months when recycled water demand is low or absent (e.g., January), and would be drawn from the ponds throughout the on-site demand season. During the on-site demand period, daily production from the White Slough WPCF would remain available to meet off-site demands. Any off-site demands exceeding the daily output of the WPCF would be met by incorporating a supplemental source of water (i.e., WID or groundwater) into the recycled water distribution system.

Another option was considered in which recycled water is not seasonally stored, requiring on-site and off-site demands to "compete" for the daily production from the White Slough WPCF. This option was ruled out by City staff since such a "competition" scenario is inconsistent with the City's goals of maximizing the use of its recycled water supplies[14].

The following analyses of off-site recycled water distribution alternatives assume either (1) seasonal storage for on- *and* off-site demands, or (2) seasonal storage for on-site demands *only*. While the no-storage option is not assumed, a no-storage scenario is implied as part of the No Project alternative

[14] The City could satisfy approximately 1,700 AFY of demand under a no-storage scenario, which is less than the City's current groundwater overdraft rate (the City pumps approximately 17,000 AFY, while the sustainable yield was determined to be approximately 15,000 AFY).

described below. The storage option is indicated for each of the distribution system alternatives described below.

The seasonal storage ponds are assumed to be lined, in order to mitigate the potential for percolation/infiltration. Additionally, it should be noted that if the assumptions relating to the on-site demands are changed or negated in the future, the size, and scope of seasonal storage alternatives could be dramatically changed.

At the present time, the City does not have any available land to site seasonal storage ponds other than the City-owned property surrounding the White Slough WPCF.

### 6.2.2 Description of Distribution System Alternatives

#### Alternative A – Seasonal Storage for On- and Off-Site Demands

The layout for Alternative A is shown in **Figure 6-1**. The main corridors for this alignment include: North Thornton Road, West Kingdon Road, Harney Lane, along the western edge of the future development areas (Westside and Southwest Gateway) west of Lower Sacramento Road between Harney Lane and the main WID South Main Canal, and along the WID South Main Canal from Harney Lane to Turner Road. One major crossing of the WID canal is required at Harney Lane under this alternative. Other crossings of the WID canal would be expected for the irrigation laterals serving the various schools, parks, and other users near the main transmission lines. The length of the transmission mains totals approximately 87,000 lineal feet, with pipe diameter sizes ranging from 6-inches to 30-inches. A pump station would also be located at the White Slough WPCF to meet the required system pressures required for distribution.

During peak irrigation demand periods (June, July, and August), the daily recycled water supply from the White Slough WPCF would not be sufficient to meet demands for this service area. Therefore, seasonally stored recycled water supplies located near the White Slough WPCF would be used in order to meet peak demands. The approximate volume of the seasonal storage pond(s) would be 3,000 AF.

Refer to Attachment B of **Appendix B** for reference information about each of the potential users identified in Figure 6-1, including users names (where applicable), meter numbers (where applicable), locations, demands, type of use, and site size.

#### Alternative A – Seasonal Storage for On-Site Demands

Alternative A could also be implemented using Seasonal Storage for On-Site Demands. Under this alternative, the alignment would follow the same corridors described above and the distribution system would be the same. One major crossing of the WID canal is required at Harney Lane under this alternative. Other crossings of the WID canal would be expected for the irrigation laterals serving the various schools, parks, and other users near the main transmission lines. The layout this alternative is shown in **Figure 6-2**.

Approximately 2,400 AF of recycled water would be seasonally stored in order to meet "on-site" demands. During peak irrigation demand periods (June, July, and August), the recycled water supply from the White Slough WPCF would not be sufficient to meet the demand for the "off-site" recycled water users. Therefore, additional water supplies would be added from a proposed WID canal intake/pump station, assumed to be located at Beckman Park, to the recycled water distribution system in order to serve the total "off-site" users' demand[15]. The actual location of the WID intake would be determined during the design phase for this project.

[15] Incorporating WID supplies would not increase the size of the pipeline facilities in Alternative A. Rather, utilizing raw WID water will reduce the required volume of seasonal storage, in turn reducing the total unit cost of water in the system. Refer to **Appendix J** for detailed cost information.

Refer to Attachment B of **Appendix B** for reference information about each of the potential users identified in Figure 6-2, including users names (where applicable), meter numbers (where applicable), locations, demands, type of use, and site size.

### Alternative D – Seasonal Storage for On- and Off-Site Demands

Alternative D is illustrated in **Figure 6-3.** The main corridors of this alignment include Kingdon Road and Harney Lane west of the Union Pacific Railroad tracks. The transmission mains length totals approximately 37,000 lineal feet in total length with pipe diameter sizes ranging from 12-inches to 30-inches. One pump station located at the White Slough WPCF would be required to meet the irrigation demands under Alternative D.

Although the daily recycled water output from the White Slough WPCF would be sufficient to meet peak irrigation demands during June, July, and August under the Seasonal Storage for On-Site Demands option, a 3 MG recycled water storage tank at the WPCF would be required for operational storage. As such, it has been assumed that increasing the size of seasonal storage ponds by approximately 500 MG to accommodate Alternative D demands (requiring approximately 1,600 AF of total storage) would be preferred over the construction and operation of a large (3 MG) operational storage tank. Thus, Seasonal Storage for On- and Off-Site Demands remains the preferred option for Alternative D.

Refer to Attachment B of **Appendix B** for reference information about each of the potential users identified in Figure 6-3, including users names (where applicable), meter numbers (where applicable), locations, demands, type of use, and site size.

### Water Quality Impacts of Recycled Water Project Alternatives

No negative water quality impacts on the City's effluent receiving waters (Dredger Cut and the Delta), including impacts to beneficial uses, are anticipated as a result of removing and/or reducing effluent discharge during portions of the year. Since Dredger Cut and the Delta are both tidally influenced, water level changes in either will not be significantly influenced by the reduction or removal of effluent flows.

Additionally, the City does not expect any adverse water quality impacts to groundwater as a result of using recycled water for irrigation. In fact, the use of the City's treated effluent for irrigation may improve groundwater quality in some areas of the City's RWSA (mainly in the western portion of the RWSA, near Interstate 5) which currently experience elevated TDS levels as a result of saltwater intrusion from the Delta.

**Figure 6-1: Alternative A – Seasonal Storage for On- and Off-Site Demands**

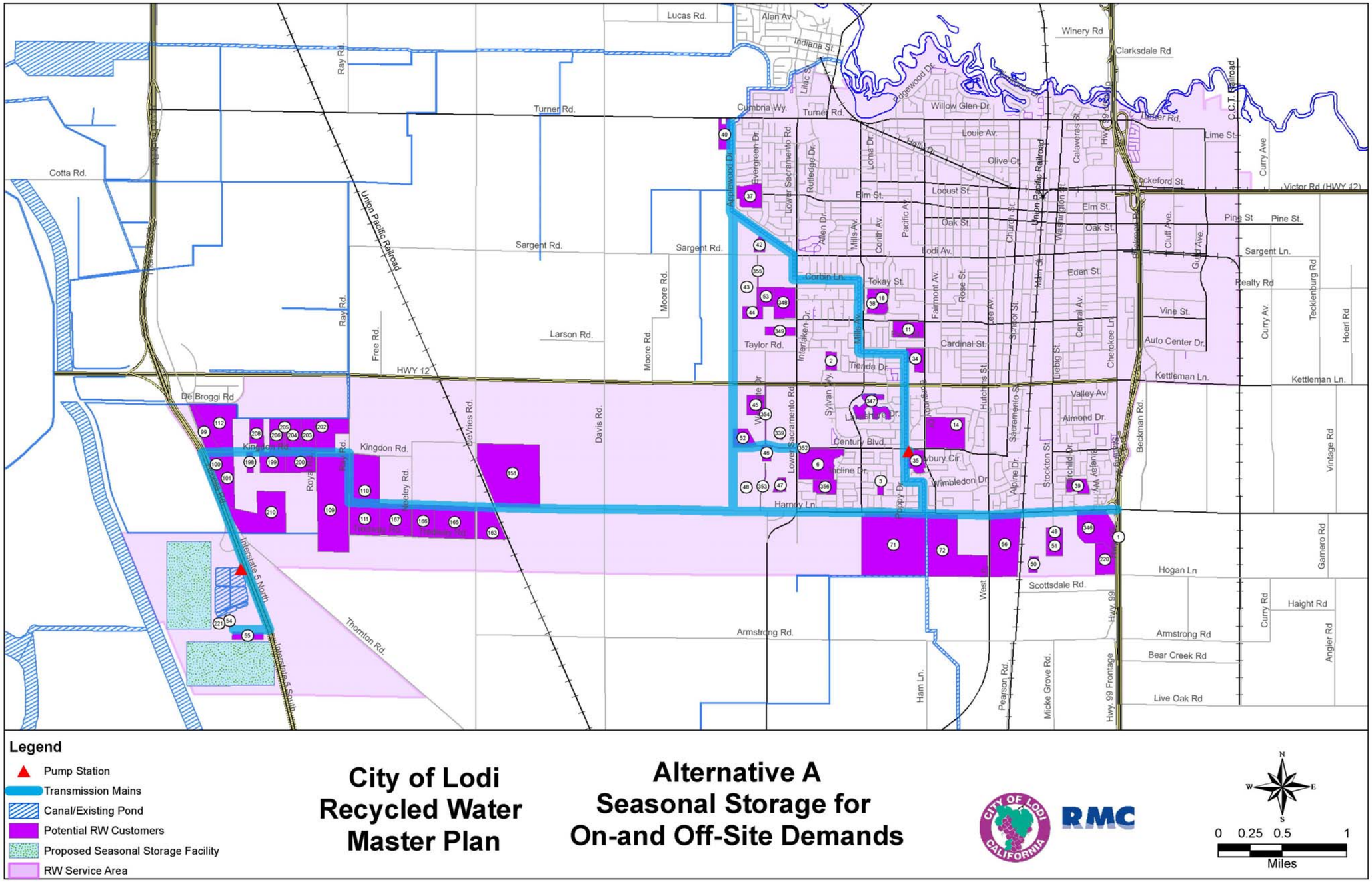


**Figure 6-2: Alternative A – Seasonal Storage for On-Site Demands**

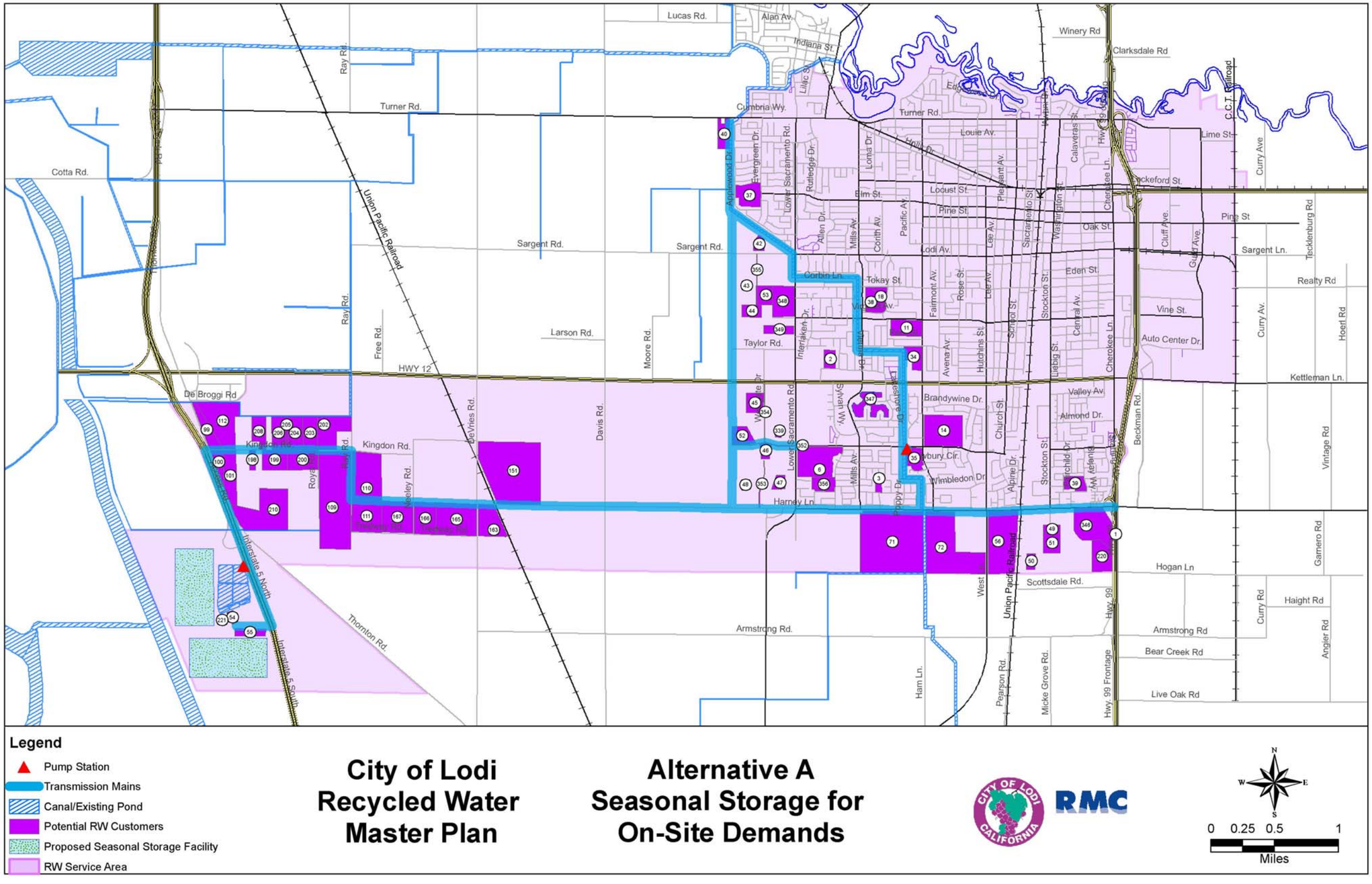
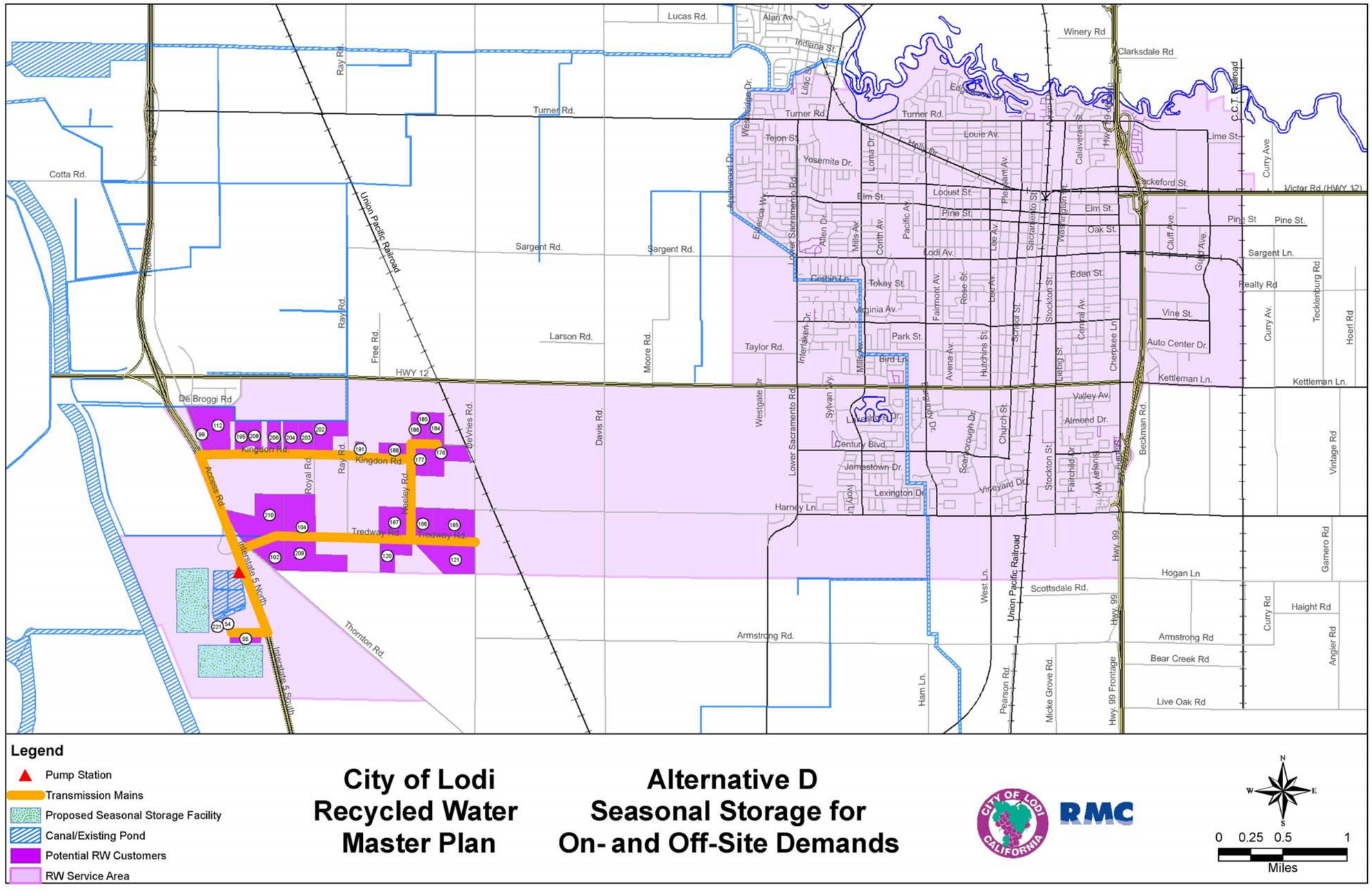


**Figure 6-3: Alternative D – Seasonal Storage for On- and Off-Site Demands**



### No Project Alternative

In addition to the project alternatives discussed above, as part of this study a "No Project" alternative was also considered. The "No Project" alternative represents a scenario in which recycled water use within the City's RWSA is not implemented.

Although the "No Project" alternative would avoid substantial implementation capital costs and potential short-term environmental impacts, such as traffic impacts from construction activities, impacts to portions of the City's parks and schools, and noise impacts from operation of equipment and vehicles, there would be several major long-term consequences associated with failing to implement any of the alternatives identified as part of this study:

- **Groundwater supplies would not be offset.** Unless the City uses its WID supplies for a non-potable distribution system, City of Lodi customers would continue to use groundwater for irrigation, contributing to further basin overdraft.
- **Water supply reliability would not be improved.** Customers within the City's RWSA would continue to rely on an overdrafted groundwater basin and/or dry-year susceptible surface water during peak demand periods.
- **Available recycled water would not be put to beneficial use.** Lodi will not be able to fully utilize available (buildout) capacity of its 8.5 mgd White Slough WPCF. The available tertiary treated water would not be used to benefit the community (e.g., irrigation of agricultural areas, parks, and schools)

### 6.2.3 Non-Recycled Water Alternative

As discussed previously, the City is planning to construct a surface water treatment plant to treat its WID surface water supplies for use by potable water customers within the City. The City plans to proceed with this project regardless of the outcome of this RWMP. Although use of the City's surface water supplies will partially offset groundwater supplies and improve water supply reliability, the City's recycled water supplies will not be put to beneficial use without a recycled water project. Preliminary cost estimates for the City's surface water treatment plant are not included, as the project is still under study.

### 6.2.4 Water Conservation/Reduction Analysis

The City has a variety of water conservation (or demand management) measures in place. Chapter 5 of the City's 2005 UWMP discusses the existing demand management measures in detail. In addition to the existing measures, the City is in the process of implementing a water metering program. It is anticipated that the transition from a flat commodity rate to charges based on metered water consumption will promote additional water conservation, resulting in reduced use of groundwater and/or surface water supplies. The assumed reduction in demand as a result of metering is discussed in the City's 2005 UWMP.

Even with an assumed reduction in demand from water metering, the city is expects to face supply shortages in the future, as indicated in **Figure 1-1**. As discussed previously, the City considers its recycled water supplies as a possible solution to the need for future (non-potable) water supplies.

## 6.3 Alternative Evaluation

This section presents the results of the evaluation conducted for each alternatives identified in Section 6.2.2.

### 6.3.1 Evaluation Criteria

The criteria used to evaluate the recycled water project alternatives are summarized below in **Table 6-3.** Additionally, the hydraulic analysis results were used to develop the facility requirements which were the basis for the cost estimates used as part of the evaluation process.

**Table 6-3: Evaluation Criteria**

| Evaluation Criteria | Description |
|---|---|
| Estimated Cost | Total cost per acre-foot of water delivered (capital costs to implement alternative, as well as operational costs). |
| Flexibility | Ease with which (1) plans can be changed to address unforeseen circumstances, including ability to alter the plan to account for changes in planning assumptions regarding future demand patterns, projected resources or other uncertainties, and (2) project can be phased. |
| Meet Project Goals | Ability to meet the project objectives established throughout this RWMP. |
| Ease of Implementation | Ease with which alternative can be designed, permitted, and constructed. This also includes the ability to overcome obstacles (such as utility crossings). |
| Environmental/Social Impacts | Various impacts including construction-related impacts. |
| Regional Plan Adaptability | Degree of synergy with potential regional recycled water system. |

#### Hydraulic Analysis

A hydraulic analysis using $H_2O$Map was performed to determine the estimated size for the pipelines, pump stations, and storage facilities required to serve the recycled water service area. The hydraulic criteria shown in **Table 6-2** were used as a basis for the model. Alternative A was modeled under two storage scenarios:

- Seasonal Storage for On- and Off-Site Demands included seasonal storage at the White Slough WPCF, allowing the exclusive use of recycled water in the distribution system throughout the year.
- Seasonal Storage for On-Site Demands assumed a constant recycled water production of 8.5 mgd at the WPCF. Additional supplies needed for peak demands were added to the system via a WID canal intake and pump station near Beckman Park.

Alternative D was modeled using Seasonal Storage for On- and Off-Site Demands assumptions, allowing the exclusive use of recycled water in the distribution system throughout the year. Schematics illustrating the configuration of the Alternative A (Storage Options 1 and 2) and Alternative D hydraulic models can be found in **Appendix J**. See also Figure 6-1, Figure 6-2, and Figure 6-3.

#### Alternatives Description

The facilities required for each alternative based on the hydraulic analyses performed using the $H_2O$Map Water hydraulic model are summarized in **Table 6-4**. The facility requirements are discussed in more detail below.

**Table 6-4: Summary of Facilities for Each Alternative**

| | Pipe Diameter (inches) | Length of Transmission Main [a] (LF) | Storage Facility and Pump Station |
|---|---|---|---|
| **Alternative A** Seasonal Storage for On- and Off-Site Demands | 30" | 210 | • Approx. 3,000 AF seasonal storage facility [b] adjacent to the White Slough WPCF (for both "on-site" and "off-site" recycled water demands) [c]<br>• 1,590-hp pump station at WPCF (5 duty and 1 standby 265-hp pumps) |
| | 24" | 44,710 | |
| | 16" | 2,600 | |
| | 12" | 26,360 | |
| | 8" | 8,200 | |
| | 6" | 5,270 | |
| | **Total** | **87,340** | |
| **Alternative A** Seasonal Storage for On-Site Demands | 30" | 210 | • Approx. 2,400 AF seasonal storage facility [b] adjacent to the White Slough WPCF (for "on-site" recycled water demands only) [c]<br>• 780-hp pump station at WPCF (3 duty and 1 standby 195-hp pumps)<br>• 405-hp pump station at WID canal (2 duty and 1 standby 135-hp pumps) |
| | 24" | 44,710 | |
| | 16" | 2,600 | |
| | 12" | 26,360 | |
| | 8" | 8,200 | |
| | 6" | 5,270 | |
| | **Total** | **87,340** | |
| **Alternative D** Seasonal Storage for On- and Off-Site Demands | 30" | 190 | • Approx. 1,600 AF seasonal storage facility [b] adjacent to the White Slough WPCF (for both "on-site" and "off-site" recycled water demands) [c]<br>• 930-hp pump station at WPCF (5 duty and 1 standby 155-hp pumps) |
| | 24" | 8,150 | |
| | 16" | 12,530 | |
| | 12" | 12,280 | |
| | **Total** | **33,140** | |

Footnotes:

a. Due to refinements made during hydraulic analyses, lengths differ slightly from lengths presented for the Conceptual Alternatives in Table 6-1.

b. Refer to Section 6.2.1 for a description of seasonal storage options and "on-site" and "off-site" recycled water demands.

c. For cost estimation purposes, all seasonal storage facilities have been assumed to be 10 feet deep. Refer to **Appendix J** for detailed information.

### Alternative A – Seasonal Storage for On-and Off-Site Demands

- ***White Slough WPCF:*** To deliver recycled water to the identified potential customers, the City would need to operate five 265-hp pumps at the White Slough WPCF during peak hour demand conditions, and one pump during average day demand conditions. At least one pump would be on a VFD in order to allow the pump to ramp down for the reduced average day flows. A sixth pump would be included for redundancy.
- ***Transmission Mains:*** The alternative would require approximately 42,000 lineal feet (LF) of PVC pipe and 45,000 LF of welded steel pipe (WSP)[16]. See **Appendix J** for detailed information.

[16] For cost estimating purposes, pipe material has been assumed to be PVC for pipe diameters between 6- and 16-inches, and steel for pipe diameters 18-inches and larger. Other pipe materials may be appropriate for this application and should be investigated further during the design phase.

- ***Storage:*** Seasonal Storage for On-and Off-Site Demands is assumed for this alternative. A storage pond with a volume of approximately 3,000 AF would be required to store the recycled water required to supply the demands in both the on-site and off-site systems. See **Appendix J** for detailed seasonal storage pond information.

**Alternative A – Seasonal Storage for On-Site Demands**

- ***White Slough WPCF:*** To deliver recycled water to the identified potential customers, the City would need to operate three 195-hp pumps at the White Slough WPCF during peak hour demand conditions, and one pump during average day demand conditions. At least one pump would be on a VFD in order to allow the pump to ramp down for the reduced average day flows. A fourth pump would be included for redundancy.
- ***Transmission Mains:*** The alternative would require approximately 42,000 LF of PVC pipe and 45,000 LF of WSP (same as above). See **Appendix J** for detailed information.
- ***Storage:*** Seasonal Storage for On-Site Demands is assumed for this alternative. A storage pond with a volume of approximately 2,400 AF would be required to store the recycled water to supply the demands in the on-site system (in order to reserve as-needed daily production from the WPCF for the off-site system). See **Appendix J** for detailed seasonal storage pond information.
- ***WID Canal Intake and Booster Pump Station:*** In order to meet demands exceeding the daily production at the WPCF (8.5 mgd), the incorporation of WID water supplies would be necessary. An intake and booster pump station consisting of three 135-hp pumps (two duty and one standby) would be required near the WID canal. The recommended location of the intake and pump station is at Beckman Park.

**Alternative D – Seasonal Storage for On-and Off-Site Demands**

- ***White Slough WPCF:*** To deliver recycled water to the identified potential customers, the City would need to operate five 155-hp pumps at the White Slough WPCF during peak hour demand conditions, and one pump during average day demand conditions. At least one pump would be on a VFD in order to allow the pump to ramp down for the reduced average day flows. A sixth pump would be included for redundancy.
- ***Transmission Mains:*** The alternative would require approximately 25,000 LF of PVC pipe and 8,300 LF of WSP. See **Appendix J** for detailed information.
- ***Storage:*** Seasonal Storage for On-and Off-Site Demands is assumed for this alternative. A storage pond with a volume of approximately 1,600 AF would be required to store the recycled water required to supply the demands in both the on-site and off-site systems. See **Appendix J** for detailed seasonal storage pond information.

### 6.3.2 Evaluation Results

Based on the evaluation criteria presented in **Table 6-3** and the cost estimates presented in **Table 6-6**, the alternatives were evaluated as shown in **Table 6-5** below. A weighting factor was applied to each of the evaluation criteria in order to reflect the relative importance of each criterion from the City's perspective. For each criterion, alternatives are scored on a scale of (1) to (3), with (1) being most favorable and (3) being least favorable. The No Project alternative was not ranked.

**Table 6-5: Project Alternative Evaluation Results**

| Evaluation Criteria | Description | Criterion Weight | Alternative A | | Alternative D | |
|---|---|---|---|---|---|---|
| | | | Score [a] | Comment | Score [a] | Comment |
| **Estimated Cost** | Total cost per acre-foot of water delivered (capital and operational cost) | 50% | 3 | Capital Cost: $116.7 - $136 M<br><br>Unit Cost: $2,077- 2,422/AF | 1 | Capital Cost: $65.9 M<br><br>Unit Cost: $1,807/AF |
| **Flexibility** | Ability to change plans to address unforeseen circumstances, and project phasing capability | 25% | 2 | Project is limited to users along corridor | 2 | Project is limited to users along corridor |
| **Meet Project Goals** | Ability to meet project goals | 10% | 1 | Meets all project goals | 2 | Does not provide an interim use for WID water |
| **Ease of Implementation** | Ease with which alternative can be designed, permitted, and constructed | 5% | 2 | Citywide construction | 1 | Least amount of construction; no trenchless crossings |
| **Environmental/ Social Impacts** | Various impacts including risk of impact to biological systems and construction related impacts | 5% | 2 | Citywide construction | 1 | Least amount of construction |
| **Regional Plan Adaptability** | Degree of synergy with potential regional recycled water system | 5% | 3 | 18% of annual recycled water supplies remain available for a regional system | 2 | 37% of annual recycled water supplies remain available for a regional system |
| | | **Total Score:** | **2.45** | | **1.40** | |

Footnotes:
a. Criterion ranking: (1) most favorable; (3) least favorable.

## Cost Estimates

Planning level cost estimates were developed for each alternative. The cost estimates are summarized in **Table 6-6**. Many of the unit cost assumptions used to develop the cost estimates are presented in the *Key Assumptions TM* in **Appendix A**; additional assumptions are presented with the detailed cost estimates for each alternative in **Appendix J**.

**Table 6-6: Project Alternative Cost Estimates**

| Alternative | Potential Demand Met with Recycled Water (AFY) | Estimated Cost | | | Unit Cost of Recycled Water $/AF |
|---|---|---|---|---|---|
| | | Total Project Cost ($M) | O&M Cost ($M/yr) | Annualized Cost ($M/yr) | |
| **Alternative A** (Seasonal Storage for On-and Off-Site Demands) | 4,996 | 136.4 | 1.43 | 12.1 | **2,422** |
| **Alternative A** (Seasonal Storage for On- Site Demands) | 4,996 | 116.7 | 1.25 | 10.4 | **2,077** |
| **Alternative D** (Seasonal Storage for On-and Off-Site Demands) | 3,720 | 65.9 | 0.72 | 5.9 | **1,807** |
| **No Project Alternative** | 0 | 0 [a] | 0 [a] | 0 [a] | **0** [a] |

Footnote:

a. Costs not associated with the construction of recycled water distribution system facilities are unknown at this time.

## Agricultural Reuse Project

The project with the most favorable score is Alternative D for the following reasons:

- **Cost effectiveness.** Alternative D would have the lowest capital cost ($65.9M) and cost per AF of recycled water ($1,807) of the project alternatives.
- **Minimal Impacts.** Alternative D would avoid construction near residential areas, parks and schools, as well as crossings at the UPRR tracks and the WID canal.
- **Multiple Benefits.** Alternative D (as opposed to the No Project alternative) would reduce local dependence on groundwater for irrigation, improve water supply reliability, and utilize existing and future production of recycled water at the White Slough WPCF.

As shown in **Table 6-7**, the total capital cost for Alternative D is $65.9M. A more detailed cost estimate is provided in **Appendix J**.

**Table 6-7: Estimated Costs for Alternative D**

| Project Element | Estimated Cost, $ |
|---|---|
| Pipeline | 6,017,000 |
| Pump Station | 580,000 |
| Storage Facility | 19,834,000 |
| **Raw Construction Cost** | **27,033,000** |
| Contractor Overhead & Profit (10%) | 5,407,000 |
| Change Order Allowance (5%) | 1,352,000 |
| **Subtotal Construction Cost** | **33,792,000** |
| Land and Right of Way [a] | 7,966,000 |
| Planning Phase Unknown Allowance (30%) | 10,138,000 |
| **Construction Cost** | **51,896,000** |
| Environmental Documentation (2%) | 1,038,000 |
| Engineering, Administration, and Legal (10%) | 5,190,000 |
| Construction Management (15%) | 7,784,000 |
| **Capital Cost** | **65,908,000** |
| Annual O&M Costs | 712,000 |
| Annualized Capital Costs [b] | 5,164,000 |
| **Total Annualized Costs** | **5,868,000** |
| **Cost per AF [c]** | **1,807** |

Footnotes:
a. Comprised of land costs for seasonal storage ponds.
b. Assumes 6% interest over 25 years.
c. The unit cost does not include the O&M cost associated with operating the White Slough WPCF, nor does in include any offsets for potential future water service expansion capital costs.

### Urban Non-Potable Water System Project

Because Alternative D does not provide an interim use for WID water, it is also recommended that a second, parallel project be pursued to achieve this objective. Specifically, it is recommended that the City construct a non-potable water distribution system to supply raw WID water to urban customers for irrigation purposes. This system could be integrated with Alternative D in the future, at which point recycled water would replace WID water and the City's WID supplies would be treated and used solely for its potable distribution system.

Although a non-potable system would likely resemble the urban portions of Alternative A, various aspects of the project would require further study and cannot be quantified at this time. Additionally, portions of a non-potable system using WID water initially would not be eligible for the SWRCB Water Recycling Funding Program.

## 6.3.3 Recommended Project

Based on the results of the project evaluation results provided in the previous section, Alternative D is the preferred project based on cost and facility requirements. However, the potential recycled water users for this alternative are currently using water extracted from private wells or receiving water from WID. The cost for pumping from private wells is $40/AFY. The cost of WID water is approximately $36/AFY. At this time, it does not appear that a cost effective project is available that would attract these potential users from accepting recycled water over the current supply of water.

# Chapter 7 Preferred Project

Based on the results described in Chapters 5 and 6, the City will need to evaluate opportunities for outside funding to reduce costs for a recycled water system relative to currently available sources. However, it is anticipated that the City, in its efforts to develop sustainable long term water supplies for the community will continue to keep these water supply options open. The potential for moving forward with the following two parallel projects to achieve the City's water supply and wastewater management objectives will need to be evaluated on an ongoing basis:

- **An agricultural reuse project** (Alternative D, discussed in Chapter 6). This system would be supplied with recycled water.
- **A non-potable water system serving urban customers**. It is envisioned that this non-potable system will ultimately be supplied with recycled water; in the short term, the system would be supplied with raw WID water.

The agricultural reuse project is the primary focus of the remainder of this report.

The non-potable system serving urban customers is not discussed in detail, as it will require separate study outside the scope of this project. Discussion of how it might integrate with Alternative D in the future is included in **Section 7.2**.

## 7.1 Agricultural Reuse Project (Alternative D)

Alternative D was selected as the preferred project, although not cost effective at this time, for the following reasons:

- **Cost effectiveness.** Alternative D would have the lowest capital cost ($65.9M) and cost per AF of recycled water ($1,807) of the recycled water project alternatives.
- **Timing of Demand.** All of the target agricultural users for the preferred project currently require water for irrigation, meaning that demands will be present immediately upon construction of the project. With the exception of the planned NCPA facility, the industrial target users included in this project currently use recycled water from the City.
- **Users Served.** Most of the target agricultural users that would be served by Alternative D currently rely on groundwater from an overdrafted basin. The eastern portion of the City's RWSA, which will be accessible to the preferred project, experiences higher groundwater salinity due to sea water intrusion from the Delta. Reducing groundwater extraction by these users and meeting their demands with recycled water will benefit the region's groundwater supply.
- **Minimal Impacts.** Alternative D would avoid construction near residential areas, parks and schools, as well as crossings at the UPRR tracks and the WID canal. It is likely that major streets would also be avoided, minimizing traffic impacts.
- **Multiple Benefits.** Alternative D would reduce local dependence on groundwater for irrigation, improve water supply reliability, and utilize existing and future production of recycled water at the White Slough WPCF.

### 7.1.1 Target Users

The recommended project would provide approximately 3,700 AFY of recycled water to agricultural customers, as well as several industrial customers adjacent to the White Slough WPCF. The specific agricultural users accepting recycled water have not been determined at this time. Target agricultural customers, however, are listed in **Table 7-1**. Similarly, the exact acreage that will be irrigated will depend on the types of crops being grown.

**Table 7-1** lists the acreages and estimated recycled water demands of the target users for the preferred project. As discussed in Chapter 8 (Implementation Plan), the City plans to initiate a focused outreach

campaign with agricultural users to develop a clearer understanding of interested users and their demands. Additional target users may be included in the future, depending upon the relative interest of users initially contacted and the magnitude of their recycled water demands.

**Table 7-1: Agricultural Reuse Project Target Users**

| User ID | Acreage | Estimated Recycled Water Demand, AFY |
|---|---|---|
| 54 | 3.38 | 560 |
| 55 | 9.17 | 142 |
| 99 | 16.38 | 36 |
| 102 | 36.06 | 67 |
| 104 | 52.48 | 98 |
| 112 | 50.77 | 112 |
| 120 | 28.66 | 87 |
| 121 | 57.46 | 107 |
| 165 | 50.94 | 95 |
| 166 | 27.51 | 51 |
| 167 | 39.21 | 73 |
| 176 | 34.53 | 76 |
| 177 | 19.57 | 43 |
| 184 | 19.98 | 37 |
| 185 | 9.94 | 19 |
| 186 | 10.19 | 19 |
| 188 | 19.20 | 42 |
| 191 | 5.11 | 10 |
| 195 | 14.65 | 27 |
| 202 | 33.05 | 100 |
| 203 | 18.83 | 35 |
| 204 | 19.75 | 37 |
| 206 | 17.86 | 33 |
| 208 | 15.80 | 48 |
| 209 | 62.35 | 116 |
| 210 | 67.49 | 126 |
| 221 | 2.29 | 1,524 |
| **Totals** | **743** | **3,720** |

### 7.1.2 Primary Facilities

**Table 7-2** summarizes primary facilities required to for this project. These facilities include a 930-hp recycled water pump station at the White Slough WPCF, approximately 33,300 LF of transmission mains, and approximately 1,600 AF of seasonal storage volume.

It is also likely that additional screening, filtering and/or chlorination facilities will be required to treat stored water before distribution, in order to removed algae and provide the required chlorine residual. These facilities will be particularly important once the preferred agricultural reuse project is integrated

with the City's planned non-potable system. Costs for these facilities are unknown but are anticipated to be relatively low compared to the capital cost of this project.

**Table 7-2: Agricultural Reuse Project Facilities**

| Project Facilities | Quantity | Unit |
|---|---|---|
| **Pipelines** | | |
| 6-in | - | LF |
| 8-in | - | LF |
| 12-in | 15,120 | LF |
| 16-in | 4,220 | LF |
| 24-in | 8,330 | LF |
| 30-in | 9,360 | LF |
| **Storage** | | |
| Seasonal Storage Ponds | 1,600 | AF |
| **Pumping** | | |
| 930-hp Pump Station | 1 | ea |
| Number of Duty Pumps | 5 | ea |
| Pump Size | 155 | hp |

### 7.1.3 Cost Estimate

**Table 7-3** presents the estimated costs for the project.

**Table 7-3: Agricultural Reuse Project Estimated Costs**

| Facility | | Estimated Cost |
|---|---|---|
| **Recycled Water Storage and Pumping** | | |
| Pump Station Facilities | | $580,000 |
| Seasonal Storage Ponds | | $19,834,418 |
| | **Total** | **$20,414,418** |
| **Recycled Water Backbone Pipeline** | **$/lf** | |
| 12 in diameter pipe | $124 | $1,525,430 |
| 16 in diameter pipe | $176 | $2,202,856 |
| 24 in diameter pipe | $273 | $2,226,590 |
| 30 in diameter pipe | $337 | $62,273 |
| **Recycled Water Service Laterals [a]** | **$/lf** | |
| n/a | n/a | $0 |
| | **Total** | **$6,017,000** |
| **Pipeline Appurtenances** | | |
| Appurtenances | 10% of pipeline | $602,000 |
| | **Total** | **$602,000** |
| | **Raw Construction Cost** | **$27,033,000** |
| | Contractor OH&P (10%) | $5,407,000 |
| | Change Order Allowance (5%) | $1,352,000 |
| | **Subtotal Construction Cost** | **$33,792,000** |
| | | |
| | Land & Right of Way | $7,966,000 |
| | Construction Phase Allowance (30%) | $10,138,000 |
| | **Subtotal Construction Cost** | **$51,896,000** |
| | Environmental Documentation (2%) | $1,038,000 |
| | Engineering, Administration, and Legal (10%) | $5,190,000 |
| | Construction Management (15%) | $7,784,000 |
| | **Total Project Cost** | **$65,908,000** |
| **Operations & Maintenance** | | |
| | Annual Operation | $53,432 |
| | Annual Maintenance | $659,000 |
| | **Total** | **$712,000** |
| | **Present Worth O&M** | **$9,557,000** |
| | **Total Present Worth Cost** | **$75,465,000** |
| | **Annualized Costs** | **$5,868,000** |
| | **Recycled Water Yield, AFY** | **3,720** |
| | **Annual Unit Cost, $/AF [b]** | **$1,800** |

Footnote:

a. The total potential recycled water demand that is adjacent to the proposed backbone pipeline system exceeds the available supply. Therefore, no service laterals are anticipated.

b. Rounded to nearest $50/AF

### 7.1.4 Implementation Considerations

Key issues that will need to be taken into consideration prior to implementing any alternative include the following:

- **Construction/traffic impacts** – Although the alignment presented in this report does not include any major roadways, changes may occur which force a portion of the alignment into busier roads. In any event, traffic impacts will need to be evaluated prior to confirming the alignment.
- **User retrofit needs** – The majority of the agricultural customers proposed for this project use groundwater from private wells for irrigation currently, and will require retrofits to accept and distribute recycled water from a City-owned transmission main or service lateral. Several of the target users also accept nonpotable, raw WID water for irrigation either currently or at some point in the past; since these deliveries are made using WID's canal system, these users would also require retrofits to accept recycled water. The locations, design, and operation of the user retrofits will need to be considered during subsequent outreach, planning and design phases of this project.
- **Back-up water supply requirements** – Since most of the target agricultural users currently irrigate with private well water, and would retain their wells after accepting recycled water, back-up water supply connections (to potable water or otherwise) are not anticipated to be necessary.
- **Water quality needs** – Additional investigation and coordination with potential agricultural customers and agronomists regarding specific water quality concerns, objectives, and any on-going maintenance needs will need to be conducted.

### 7.1.5 User Assurances

Securing user assurances will play a vital role in advancing the project and making it cost-effective, as pipeline lengths, and therefore project costs, are sensitive to user commitments. The target agricultural users are outside Lodi's city limits, and are therefore not subject to any City policies pertaining to the use of recycled water. Further, it remains to be determined how to provide potential agricultural users with appropriate incentives and benefits to switch from groundwater or WID water to recycled water. The City plans to work closely with target users to develop an appropriate package of benefits; at that time, use agreements will also be developed.

Maximizing user assurances will also involve addressing water quality needs. To this end, the City plans to work closely with target users and agronomists to develop specific water quality objectives.

### 7.1.6 Economic Analysis

The project would provide several important benefits to the City and its customers:

- **Reduced Groundwater Extraction** – Using recycled water for agricultural irrigation will reduce groundwater extraction from an already overdrafted basin, thereby increasing the amount of groundwater available to the region. Additionally, reducing groundwater extraction towards the western end of the City's RWSA may help to stem saltwater intrusion from the Delta into the underlying aquifer, thereby protecting the groundwater quality for all users in the region.
- **Reduced Wastewater Discharge** – Available tertiary treated water will be used to benefit the Lodi community, namely for the irrigation of agricultural areas, and Lodi will be allowed to more fully utilize the White Slough WPCF's available capacity. Seasonally storing recycled for irrigation will dramatically reduce the City's wastewater discharges to the Delta.

Benefits to agricultural users outside City limits include the following:

- **High-Quality Irrigation Water** – The City's recycled water is generally of high quality, and is expected to be of comparable or higher quality for typical irrigation practices than groundwater

from wells inside the RWSA, particularly in the western portion of the RWSA, where salt water intrusion has diminished the quality of groundwater wells.

- **Reduced Salt-Water Intrusion** – By using recycled water for irrigation, agricultural customers would reduce salt water intrusion from the Delta via reduced groundwater extractions, thereby acting to protect regional groundwater resources and help ensure the quality of private groundwater wells as a backup supply.
- **Improved Water Supply Reliability** – Agricultural customers using recycled water will reduce their susceptibility to drought conditions, especially those using WID water as a supply source, as recycled water production is not significantly influenced by climatic changes.
- **Availability of Pressurized Water** – The City will distribute recycled water in a pressurized pipeline network, providing agricultural users with adequate pressures for most irrigation purposes.

Given the project's unit cost and the benefits listed above, the City believes that the project warrants further investigation. However, a more detailed cost/benefit analysis will need to be completed prior to implementation to confirm the financial viability of the project (see Chapter 8).

## 7.2 Urban Non-Potable Water System Project

The urban non-potable water system project would utilize the City's existing WID supplies for a period of time prior to the construction and implementation of the City's planned surface water treatment plant. WID water will be distributed to urban customers via a nonpotable distribution system that would resemble portions of Alternative A presented in Chapter 6. After the completion of the surface water treatment plant, whereupon WID supplies would be used to meet potable demands, the City plans to integrate the non-potable distribution system with the agricultural reuse project. The size and scope of the integrated recycled water distribution system, as well as the recycled water availability at the time of integration, will be determined through separate studies and are not discussed in this report, as they cannot be determined at this time.

Target users for the non-potable project, regardless of the non-potable supply (raw WID water or recycled water), will likely include the potential urban customers identified for Alternative A. Additional target users for the non-potable system may be identified through the course of additional studies.

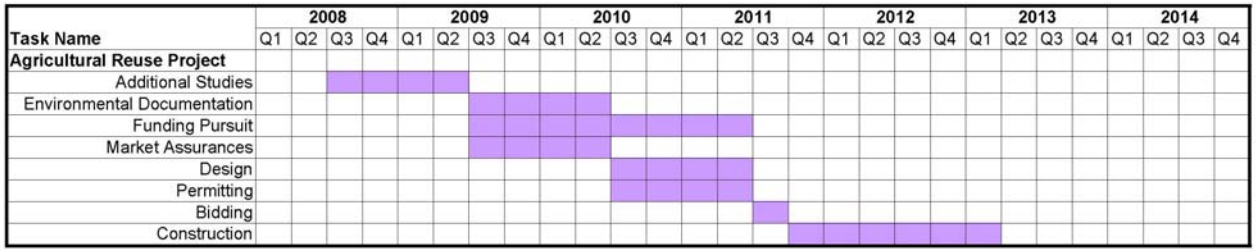
In the short term, the non-potable system would be supplied by raw WID water. In the long term, upon integration with the agricultural reuse project, the City plans to supply the non-potable system with recycled water. The connection between the two projects will require further study.

Upon integration with the agricultural reuse project, it is likely that the resulting distribution system will require several incremental improvements to accommodate changes in demands, pressures, and storage needs. In particular, it is likely that the size or number of seasonal storage ponds would need to increase, and that some form of booster pumping may be necessary to maintain adequate pressures for urban customers. More detailed information about required facilities is not available at this time, and will be developed through the course of future studies.

# Chapter 8 Implementation Plan

At this time, an economically feasible project is not available. In the event that funding opportunities become available which would substantially reduce the cost of the preferred project, a hypothetical implementation schedule for the Agricultural Reuse Project is shown in **Figure 8-1**. The schedule depends heavily upon the outcome of several additional studies, including outreach to target agricultural users and the development of appropriate funding mechanisms and revenue sources. The dates shown in **Figure 8-1**, therefore, are subject to change.

**Figure 8-1: Implementation Schedule**




## Supplemental Planning Activities, including Financial Planning

Prior to engaging in more in-depth pre-design and environmental documentation, the City should conduct a number of additional studies and outreach activities. These studies and activities should include: additional, focused outreach to target agricultural users to better understand recycled water interests and concerns; development of specific water quality objectives and control measures for potential users; and, further investigations of the economic feasibility of the project in the form of a detailed financial plan.

The detailed financial plan should look carefully at the revenue sources necessary to recover funds obtained to construct the preferred project. Because the target agricultural users currently have access to one or more lower cost supply sources (i.e., private groundwater wells and/or WID water), incentives for switching to recycled water will likely be necessary. The City will need to consider the limit in revenue that any incentives may impose.

Potential revenue sources for the project could include:

- **Revenue from Recycled Water Sales** – It is anticipated that the City will establish the price of recycled water comparable to or lower than the price of WID and groundwater supplies in order to provide an incentive to target recycled water customers to connect to the system. This practice is common in the recycled water industry, with recycled water prices ranging between 50% and 90% of the price of water being replaced.
- **Revenue from Recycled Water Surcharge** – A surcharge could be imposed on all City potable water users. This surcharge, however, would be infeasible until customers within City limits begin to use recycled water, which will not occur until the City's planned non-potable project is integrated with the agricultural reuse project.
- **Wastewater User Charges** – The City is in the process of studying the application of industrial (primarily cannery) wastes and biosolids in the vicinity of the White Slough WPCF. If the results of the study indicate that the City has been over-applying its treated effluent for blending and dilution purposes, the City may have recourse to link the promotion of recycled water use to its sewer rates. The City expects to have the results from this study in 2009.
- **Development Impact Fees –** Depending on the timing and location of new development, the City may be able to charge development impact fees for the construction of a recycled water distribution system. It is unlikely, however, that this option will become available until the City's planned non-potable project is integrated with the agricultural reuse project.

## Environmental Documentation

Development of this project has been undertaken with California Environmental Quality Act (CEQA) Requirements, permitting, rights of way and construction issues in mind. The formal CEQA process, however, has not been initiated. Following completion of the additional planning studies listed above, the required environmental documentation (EIR or Mitigated Negative Declaration, depending on circumstances) will be prepared. These steps represent the preliminary planning stage for the preferred project, enabling pre-design and design to begin thereafter.

## Funding Pursuit

Securing outside funding will improve the feasibility of the preferred project. The mechanisms to fund the recommended project, however, have yet to be developed. It is therefore recommended that the City considers outside funding sources while completing the financial planning effort. Potential sources of outside funding are listed in **Table 8-1**.

**Table 8-1: Potential Outside Funding Sources**

| Outside Funding Source | Comment |
|---|---|
| **SWRCB Construction Grant** | City has applied for a SWRCB Facilities Planning Grant for the planning phase of this project and consequently has a higher priority for obtaining a construction grant. A grant can cover 25% of eligible project costs provided funds are available. It is a competitive process. Readiness to proceed is currently the main criterion for selection.<br>Funds are available from repayments to the Proposition 13 fund. For fiscal year 2008/09 the SWRCB anticipates having approximately $13M available for grant funding. On an annual basis, 60% and 40% of the available funds are allocated to Northern California and Southern California projects, respectively. The project would need to be placed on the SRF Priority Project List to be considered. |
| **Proposition 84 through the IRWMP** | The City can pursue Proposition 84 funds via the Eastern San Joaquin Integrated Regional Water Management Plan (IRWMP) prepared by GBA, which includes conjunctive use and recycled water projects in which Lodi plans to participate. Proposition 84 funds will be allocated to water supply, water quality, and other projects meeting the RWQCB Region 5 goals through the IRWMP process. Proposition 84 funds will be awarded by DWR through a competitive process. Guidelines for Proposition 84 funding are anticipated for July 2008. It is conceivable that the City may be successful in funding a portion of the preferred project through Proposition 84 grants, but the possible amount is unknown at this time. |
| **SWRCB State Revolving Fund (SRF) Loan** | The City can apply for the SRF Loan program which provides low interest loans to public agencies using a priority list process.<br>If this funding is available and additional upfront capital funding is needed for the project, the City could apply for this 20-year loan. |

## Market Assurances

The City will develop market assurances for users located in the vicinity of the proposed backbone system. These market assurances could take the form of use agreements. A recycled water ordinance could not be enforced since the target users are located outside of the City boundaries.

## Permitting, Design and Construction

**Table 8-2** lists major jurisdictional and stakeholder agencies and identifies required permits and approvals required for implementing the preferred project.

**Table 8-2: Jurisdictional and Stakeholder Agencies for Permitting or Review**

| Agency Name | Permits or Special Topics |
|---|---|
| Federal Aviation Administration | Notice of Proposed Construction or Alteration |
| City of Lodi Public Works Department | Grading and Excavation Permit |
| City of Lodi | Encroachment and Street Work Permit |
| San Joaquin County | Grading, Excavation, Encroachment and Street Work Permits |
| San Joaquin County Office of Emergency Services | Hazardous Material Permit, if necessary |
| San Joaquin Valley Air Pollution Control District | Authority to Construct and Permit to Operate |
| California Regional Water Quality Control Board | NPDES Permit for construction activities and construction Storm Water Pollution Prevention Plan (SWPPP) |
| California Department of Public Health | Title 22 – Recycled Water Regulations |
| California Department of Fish and Game | Stream Bed Alteration Agreement/Waiver, if necessary |
| California Occupational Safety and Health Administration | Underground Classification for Tunnels, if necessary |
| Caltrans | Encroachment Permit |
| Pacific Gas and Electric, cable and telecom providers | Infrastructure review |

Assuming that adequate funding can be pursued in FY09/10 and secured in FY10/11, the project could move into pre-design and design in FY10/11 and into construction in FY11/12. The Project could be online by mid 2013.

# Appendix A Key Assumptions TM

# Technical Memorandum

**City of Lodi Recycled Water Master Plan**

| | |
|---|---|
| **Subject:** | **Key Assumptions** |
| **Prepared For:** | Wally Sandelin (Lodi) |
| **Prepared by:** | Andy Smith (RMC)<br>Deana Donohue (RMC) |
| **Reviewed by:** | Helene Kubler (RMC) |
| **Date:** | May 9, 2007 |
| **Reference:** | 0140-003 |

## 1 Introduction

The purpose of this technical memorandum (TM) is to document the key assumptions that will be used for development of the Recycled Water Master Plan (RWMP) project components. It is anticipated that a number of adjustments and/or updates to the assumptions will need to be made as the market assessment progresses and conceptual alternatives are developed. This TM is only intended to provide a reasonable starting point.

This TM and any subsequent changes and/or updates to the assumptions will be incorporated in the RWMP Report.

This TM is organized as follows:

1 Introduction

2 Market Assessment Methodology

3 Design Criteria

4 Cost Criteria

## 2 Market Assessment Methodology

The goals of the recycled water Market Assessment phase of this project are to identify potential uses of recycled water within the City's recycled water service area (RWSA) under a 2030[1] planning horizon. The RWSA is shown in **Figure 1**.

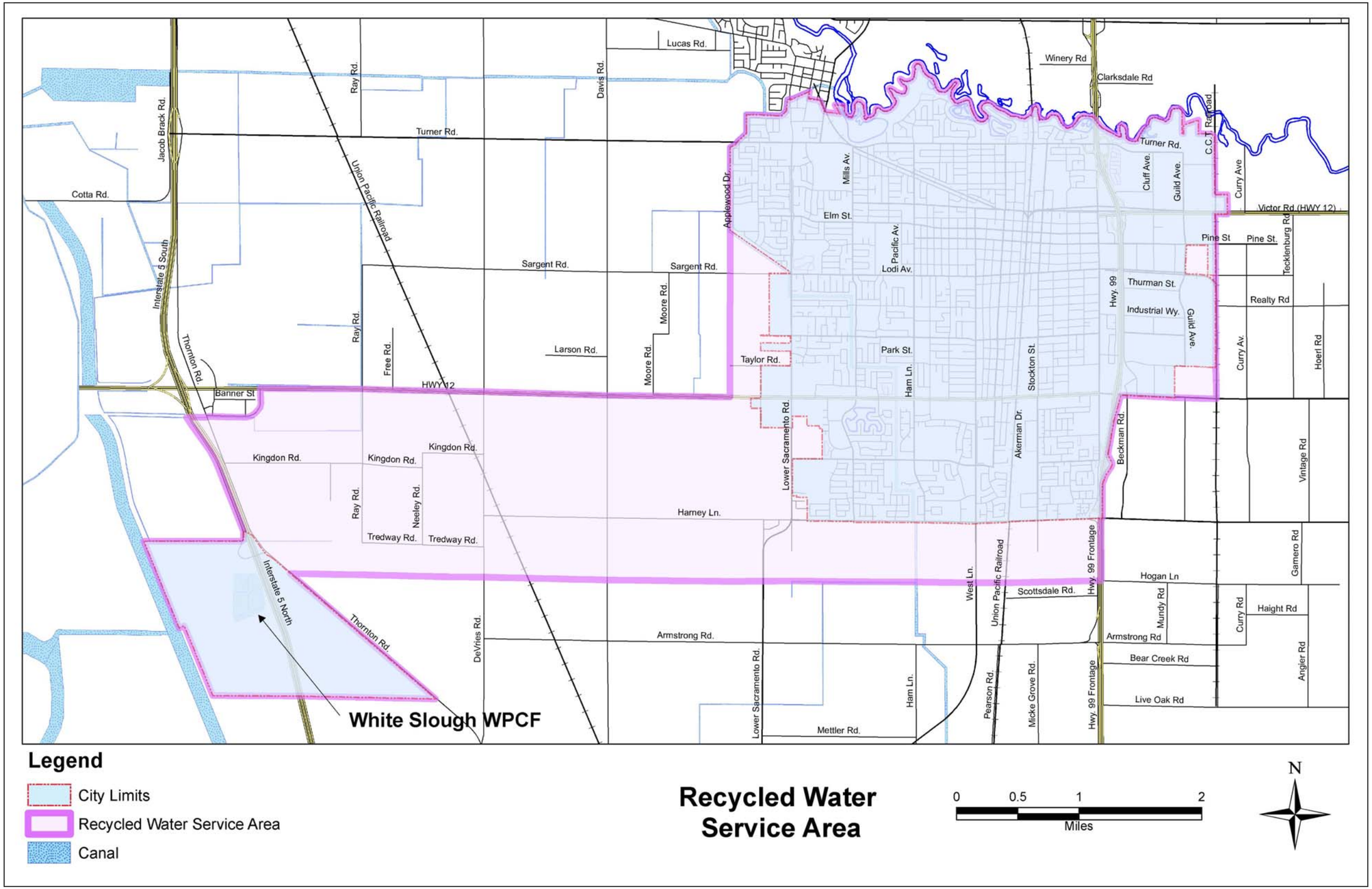
The Market Assessment will include a detailed examination of:

- Potential users and demands within the RWSA,
- Recycled water and surface water (for blending) supply availability, and
- Other implementation issues, such as the quality of recycled water and surface water supplies.

The methodologies and assumptions that will be used to conduct the Market Assessment are summarized in this section.

[1] The City's 2005 Urban Water Management Plan used a 2030 planning horizon, so the same will be used for this study.

**Figure 1: City of Lodi RWSA**



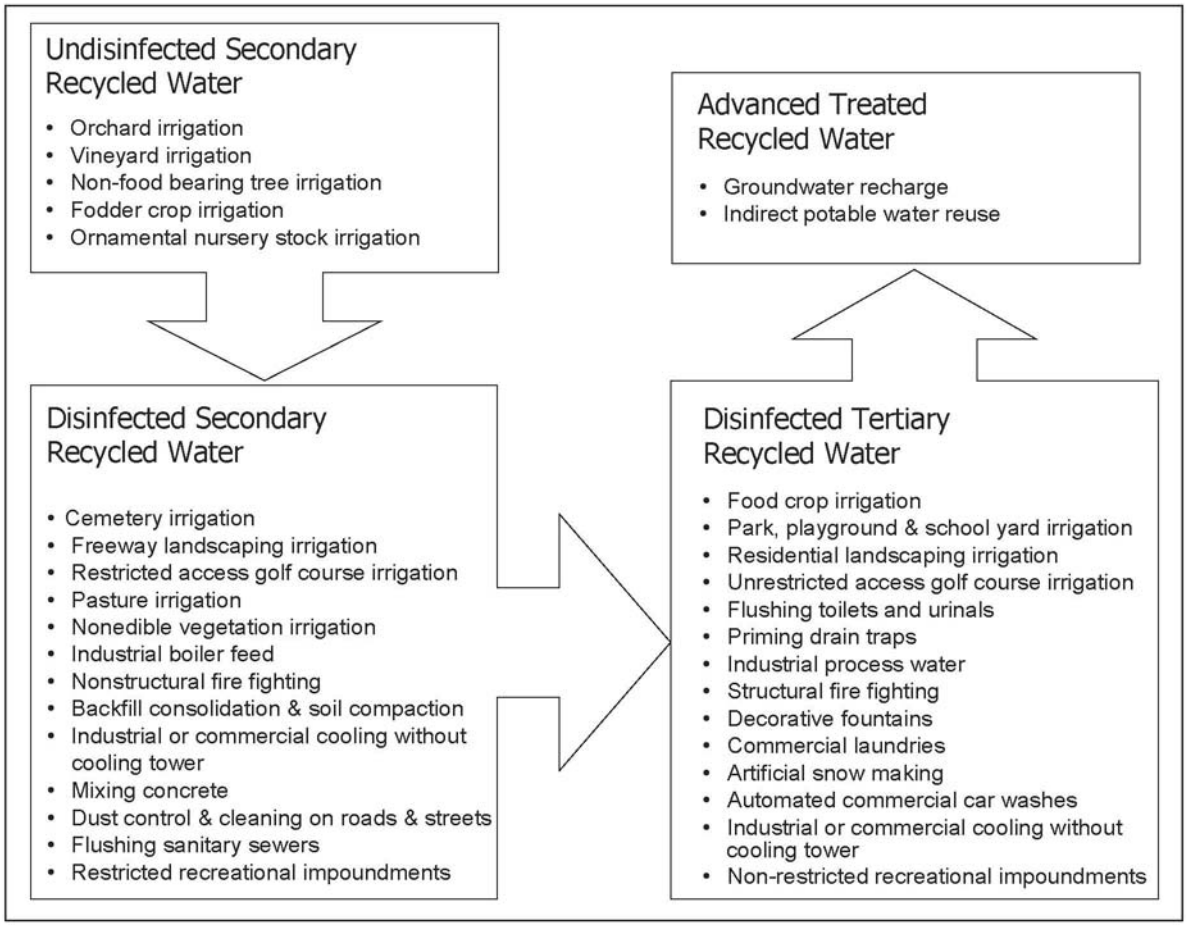
## 2.1 User Identification

The following health laws govern the use of recycled water in California:

- Health and Safety Code (Division 104; Part 12)
- Water Code (Division 7; Chapters 2, 6, 7 and 22)
- Title 22, California Code of Regulations (Division 4; Chapters 1, 2, and 3)
- Title 17, California Code of Regulations (Division 1; Chapter 5)

General recycled water uses that are currently allowed under these laws and the associated treatment requirements are presented in **Figure 2**. A complete detailed list of allowable recycled water uses is provided in **Attachment A**.

**Figure 2: General Allowable Recycled Water Uses**




Source: Title 22, California Code of Regulations (2001)

As illustrated in Figure 2, all uses except groundwater recharge are allowed with disinfected tertiary recycled water as the treatment level. All recycled water produced at White Slough Water Pollution Control Facility (WSWPCF) meets the requirements for disinfected tertiary recycled water, which will help maximize the potential for recycled water use within the planning area.

Allowable uses within the Service Area that will be considered as part of the Market Assessment are listed in **Table 1**.

**Table 1: Allowable Recycled Water Uses within the Service Area**

| Type of Use | Category | Subcategory | Comments |
|---|---|---|---|
| Irrigation | Urban | Basins/Parks and Playgrounds | ▪ Wilderness" areas (e.g., Mokelumne River Wilderness) will not be assumed to be irrigable, with the exception of a portion of the Lodi Lake Park & Wilderness Area. |
| | | Schools | ▪ Location of existing schools are included in the GIS data provided by the City |
| | | | ▪ The Delta College facilities will not be served by the Lodi recycled water system based on the facilities' remote location in relation to other likely users |
| | | Median Strips/Freeway Landscaping | ▪ The total area for existing highway and freeway median strips includes the area between the inner shoulders of both directions. |
| | | | ▪ Parts of Highway 99 and Highway 12 feature such median strips. |
| | | | ▪ Interstate 5 does not feature such median strips within the Service Area. |
| | | Artificial Lakes | ▪ Mallard Lake is the only artificial lake identified in the Service Area |
| | | Cemeteries | |
| | | Residential Landscape Irrigation | ▪ Irrigation in new development areas only will be considered, as retrofitting existing residential areas would be impractical and prohibitive |
| | | Golf Courses | ▪ There are no existing or planned golf course in the RWSA |
| | Agricultural | Food Crops | ▪ Edible Root Crops |
| | | Orchards | |
| | | Vineyards | |
| | | Ornamental Nursery | ▪ Potential users include Mainland Nursery, located at the intersection of the WID main canal and Turner Road |
| | | Sod Farms | |
| Other Uses | Industrial | Process water | |
| | | Cooling | |
| | Commercial | Toilet Flushing | |
| | | Cooling | |
| | Municipal | Dust control | ▪ Department of Public Works and contractors would be main users |
| | | Sewer flushing | ▪ Department of Public Works would be main user |

Source: Adapted from Title 22 of the California Code of Regulations

A number of allowable uses identified in **Figure 2** will not be considered in the market assessment and are not listed in **Table 1**, for the following reasons:

- Allowable use is not relevant to the Service Area (e.g., artificial snow making)
- Potential demand associated with the uses is relatively small and will not drive the alternatives definition and Master Plan recommendations. These uses include decorative fountains, automatic

car washes, and commercial laundry facilities. These uses should be considered at the design level in cases where a user is in close proximity to the recycled water pipeline alignment.

Specific potential users will be identified and a preliminary list has been provided in **Table 2**. The identification of potential recycled water users within each category will be based on relevant, available data and discussions with City staff. The relevant, available data as of March 2007 is as follow:

- Geographic Information System (GIS) data provided by the City:
  - Aerial photography
  - Existing and planned parks and schools
  - Parcel base map
  - Undeveloped parcels that straddle railroad tracks will not be included as potential users
  - Zoning base map
- Preliminary mapping and land use acreages for several recently annexed areas, including the Westside, Southwest Gateway, and Reynolds Ranch (includes Blue Shield Call Center) developments/annexations.
- Irrigation meter data
- Preliminary list of major industrial and commercial users developed by the City, see **Table 2**.

**Table 2: Preliminary List of Major Industrial and Commercial Users**

| User Name | Use Category | Comment |
|---|---|---|
| Certainteed | Industrial | Based on its location, the City does not anticipate serving this facility during the initial phase(s) of the RWMP. Certainteed will still be considered as a potential user, however. |
| NCPA Power Plant<br>• Existing Plant | Industrial | The existing NCPA power plant facility, located adjacent to WSWPCF, may obtain Title 22 certification in the future. If Title 22 certification is obtained, secondary treated effluent could be provided to the facility instead of tertiary treated effluent (WYA, 2006). For the purposes of the RWMP, however, it will be assumed that the existing NCPA facility will continue to require tertiary treated effluent. |
| • New Plant | | A second NCPA power plant will be considered as a potential recycled water customer for this RWMP, based on recent discussions with City staff. A demand of 1.5 mgd will be assumed for the facility. The facility is anticipated to be operational in 2012. |
| SJCV & MCD Fish Rearing Ponds | Industrial | |
| Blue Shield Call Center | Commercial | The Blue Shield Call Center will use recycled water supplied by the City for landscape irrigation. The building/call center will be located in the southeastern corner of the Reynolds Ranch development, will comprise about 20 acres, and will be complete in 2008 |

Source: City input (January 2007)

## 2.2 Demand Assessment

Demands for the potential recycled water users will be estimated during the Market Assessment phase of this project, prior to the development of Conceptual Alternatives for the recycled water distribution system.

The proposed methodologies for estimating the average annual recycled water demand for each category of potential users based on available data is listed in **Table 3**. A detailed description of these methodologies and the basis for the peaking factors are described in this section.

**Table 3: Proposed Demand Estimate Methodologies**

| Type of Use | Category | Use Subcategory or User Name | Metered Water Use? | Direct Input? | Demand Estimate Methodology [2] Applied |
|---|---|---|---|---|---|
| Irrigation | Urban | Basins/Parks or Playgrounds - Existing | Y | N | A |
| | | Schools Existing/Undeveloped | Y/N | N | A/B |
| | | Median Strips/Freeway Landscaping - Existing | Y | N | A |
| | | Cemeteries - Existing | N | N | B |
| | | Basins/Parks or Playgrounds – Existing/Undeveloped | N | N | B |
| | | Residential - Undeveloped | N | N | C |
| | | Landscape Irrigation in Commercial Areas- General Undeveloped | N | N | C |
| | | Landscape Irrigation in Industrial Areas - General Undeveloped | N | N | C |
| | | Mainland Nursery | N | N | B or D |
| | | Mallard Lake | N | Y | D |
| | | Other Uses - City of Lodi Public Works | N | Y | D |
| | Agricultural | Vineyards – Existing | N | N | B |
| | | Orchards – Existing | N | N | B |
| | | Miscellaneous Field Crops - Existing | N | N | B |
| Non-Irrigation | Industrial | Certainteed | N | Y | D |
| | | NCPA Power Plant | Y | Y | D |
| | | SJCV & MCD Fish Rearing Ponds | Y | Y | D |
| | | Potential NCPA Plant | N | Y | D |
| | | Industrial - General Undeveloped | N | N | C |
| | Commercial | Blue Shield Building | N | Y | D |
| | | Commercial - General Undeveloped | N | N | C |

[2] "A" = Irrigation demand based on water use data
"B" = Irrigation demand based on landscape/crop coefficient data
"C" = Irrigation and non-irrigation demands based on water usage factors
"D" = Irrigation and non-irrigation demands based on direct input

## 2.2.1 Average Annual Demand Estimate

### Methodology A – Irrigation Demand Based on Water Use Data

Methodology A relies on actual recorded water use data. This data will be used to determine the average annual irrigation demand (ID) for potential recycled water users with available metered water use data, including existing schools, parks, and Caltrans median strips (see **Table 3**) . The data provided by the City includes annual deliveries for the period from 2001 to current. The City's records do not typically denote usage (irrigation or combined) of the water measured by a meter. Therefore, simplifying assumptions were made about the percentage of the metered water that is used specifically for irrigation since obtaining this information could require significant field reconnaissance.

$$\text{Average Annual Water Use} = \frac{\sum V_i}{N_y}$$

$$\text{Average Annual ID Estimate} = (\text{Average Annual Water Use}) \times (K_{irr})$$

Where:

$V_i$ = The volume of metered water for a given year

$N_y$ = The number of years with available meter data

$K_{irr}$ = Percentage of metered water assumed to be used for irrigation per **Table 4**

**Table 4: Metered Water Use Assumptions**

| User Category | Use Subcategory | $K_{irr}$(%) |
|---|---|---|
| **Urban** | Basins/Parks or Playgrounds | 95% |
| | Schools - Existing | 60% |
| | Median Strips/Freeway Landscaping | 100% |
| | Cemeteries | 95% |

### Methodology B – Irrigation Demand based on Landscape/Crop Coefficient Data

Methodology B will be used for potential users where meter data is not available (see Table 3). Methodology B is based on *A Guide to Estimating Irrigation Water Needs of Landscape Plantings in California*, developed by the University of California Cooperative Extension (UC Extension) and California Department of Water Resources (DWR). Irrigation demand will be determined by utilizing precipitation, infiltration, irrigation efficiency and leaching rate data to calculate evapotranspiration values. Precipitation data will be obtained from the California Irrigation Management Information System (CIMIS) website. Infiltration, irrigation efficiency, and loss rate factors will be based upon UC Extension/DWR data, as well as previous RMC experience.

CIMIS Station #166 (Lodi West), located near Lodi[3], will be used as the source for the City's evapotranspiration and precipitation data. Monthly precipitation data records are available for CIMIS Station #166 between September 2000 and January 2007. This data will be compared with precipitation data provided by the City and data recorded from October 1983 to January 2001 at the currently inactivated Lodi-area CIMIS Station #42.

[3] Elevation equals 25 feet; latitude equals 38°07'48"N / 38.13; longitude equals 121°22'57"W / -121.38. The station is located on a large farming operation in a permanent pasture. The pasture is used to raise young bulls and is kept well maintained (Source: CIMIS website).

Data from the California Polytechnic State University, San Luis Obispo Irrigation Training and Research Center (ITRC) will be used in the determination of evapotranspiration rates for non-turfgrass crops (i.e., vineyards, orchards, and miscellaneous field crops).

The following equation will be used to determine unit irrigation demand for Methodology B:

$$ID = \frac{\left[(K_c) \times (ET_o) - (P) \times (I)\right] \times K_{LR}}{12 \times e_i}$$

Or:

$$ID = \frac{\left[(ET_c) - (P) \times (I)\right] \times K_{LR}}{12 \times e_i}$$

Where:

| | | |
|---|---|---|
| ID | = | Unit Irrigation Demand (feet) |
| $K_c$ | = | Crop coefficient (unitless) |
| $ET_o$ | = | Evapotranspiration, from CIMIS Station #166 (inches) |
| $ET_c$ | = | Evapotranspiration for a given crop, per ITRC [4] (inches) |
| $P$ | = | Average precipitation, from CIMIS Station #166 (inches) |
| $I$ | = | Percent Infiltration (unitless) |
| $K_{LR}$ | = | Leaching Rate Factor (unitless) |
| $e_i$ | = | Irrigation Efficiency (unitless) |

The irrigation demand will be determined by using the unit irrigation demand calculated previously, the total area of the parcel to be irrigated, and the percentage of the total parcel area that is assumed to be irrigated. The following equation will be used to calculate the irrigation demand for a parcel:

$$ID_i = (ID) \times (A) \times (K_a)$$

Where:

| | | |
|---|---|---|
| $ID_i$ | = | Irrigation demand for a specific potential recycled water user (acre-feet) |
| $A$ | = | Total area of the parcel to be irrigated (acres) |
| $K_a$ | = | Percentage of total area assumed to be irrigable (unitless) |

The total acreages for all future potential recycled water users in the Service Area will be obtained using planning information in the GIS database, discussions with City staff, developers, or other commercial and industrial customers.

The estimated percentage of parcel area assumed to be irrigable ($K_a$) for each of the various categories of potential recycled water users and the estimated unit irrigation demand for relevant use categories is listed in **Table 5**.

[4] Cal Poly Irrigation Training and Research Center, http://www.itrc.org/etdata/etmain.htm

**Table 5: Irrigable Parcel Area Assumptions and Estimated Unit Irrigation Demand**

| User Category | Type of Use | $K_a$ (%) | Estimated ID[5] (afy/acre) |
|---|---|---|---|
| **Urban** | Basins/Parks or Playgrounds | 85% | 3.38 |
| | Schools - Existing | 40% | 3.38 |
| | Cemeteries | 85% | 3.38 |
| | Median Strips/Freeway Landscaping | 100% | 3.38 |
| **Agricultural** | Vineyards[6] | 100% | 2.23 |
| | Orchards[6] | 100% | 3.06 |
| | Miscellaneous Field Crops[6] | 100% | 1.89 |

## Methodology C – Irrigation and Non-Irrigation Demands based on Water Usage Factors

For potential future residential, commercial and industrial users, irrigation and non-irrigation demands will be determined by multiplying the water use factor (WUF) associated with the type of development by a percentage of the WUF ($K_{WUF}$) assumed to represent the amount of total water demand that may be met with recycled water. The assumed values for WUF and $K_{WUF}$ are listed in **Table 6**. The following equation will be used to determine demands for Methodology C:

$$\text{Non - Irrigation Demand} = (K_{WUF}) \times (WUF)$$

**Table 6: WUF and $K_{WUF}$ Assumptions**

| User Category | User Subcategory | WUF | Units | $K_{WUF}$ (%) |
|---|---|---|---|---|
| **Urban** | Residential Development | 6,983[7] | gpcd | 5% to 40%[8] |
| | Commercial Development | 2,750[9] | gpad | 5% |
| | Industrial Development | 2,200[9] | gpad | 5% |

## Methodology D – Direct Input

A summary of the specific recycled water users is listed in **Table 7**; the direct water usage input is anticipated to be provided from the City or obtained directly from the potential user during a Large User Workshop to be held during the Market Assessment.

[5] The ET value was calculated using assumed values for crops, irrigation efficiencies, and infiltration efficiencies. A detailed description of how these numbers were developed is provided in the Market Assessment TM

[6] Does not apply to agricultural parcels that, by inspection of aerial photography, are comprised primarily by dwelling unit(s).

[7] Source: City of Lodi Design Standards. Assumes 285 gallons per capita per day (gpcd), 3.5 persons per dwelling unit (DU), and 7 DU per gross acre (6,983 = 285 x 3.5 x 7). 7 DU/acre is the aggregate historical residential density provided by the City.

[8] 5% corresponds to a non-aggressive scenario (irrigation of public spaces, dual plumbing of public buildings). 40% correspond to an aggressive scenario similar to approach taken by El Dorado Irrigation District (residential irrigation and dual plumbing of public buildings).

**Table 7: Major Industrial and Commercial Users**

| Potential User | Source of Demand Information |
|---|---|
| Blue Shield Call Center | TBD[9] |
| Certainteed | TBD[8] |
| Mainland Nursery | TBD[8] |
| Mallard Lake | City |
| Existing NCPA Power Plant | City |
| Future Potential NCPA Plant | City |
| SJCV & MCD Fish Rearing Ponds | TBD[8] |
| City of Lodi Public Works | City |

### 2.2.2 Peak Day Demand and Peak Day Peaking Factors

Peak day demands for a specific potential user will be calculated by multiplying its average day demand by a peak day peaking factor, as shown below:

$$\text{Peak Day Demand} = (\text{Peak Day Peaking Factor}) \times (\text{Average Day Demand})$$

For irrigation demands, the peak day peaking factor will be determined by calculating the ratio of the irrigation demand for the peak month (July) and the average annual irrigation demand as shown in the equation below:

$$\text{Peak Day Peaking Factor} = \frac{\text{ID (Peak Month)}}{\text{ID (Average Annual)}}$$

### 2.2.3 Peak Hour and Peak Hour Peaking Factors

The peak hour demand for a given potential user will be calculated by multiplying the peak day demand by a peaking factor as shown below:

$$\text{Peak Hour Demand} = (\text{Peak Hour Peaking Factor}) \times (\text{Peak Day Demand})$$

The peak hour peaking factor greatly depends on the user. The peak hour peaking factors assumed for each user will therefore be documented in the Market Assessment TM.

## 2.3 Water Supply Assessment

The assumptions relative to available recycled water supply are presented in this section.

### 2.3.1 Recycled Water Supplies

The White Slough Water Pollution Control Facility (WSWPCF) will be considered the sole source of unblended tertiary disinfected recycled water for the City's recycled water system. In 2006, the WSWPCF produced an average tertiary disinfected recycled water flow of approximately 6.2 mgd. For the purposes of this RWMP, recycled water supplies will be assumed as shown in **Table 8**. Assuming the

[9] TBD= The source of direct water usage input is not known at this time and will be determined as part of the Market Assessment.

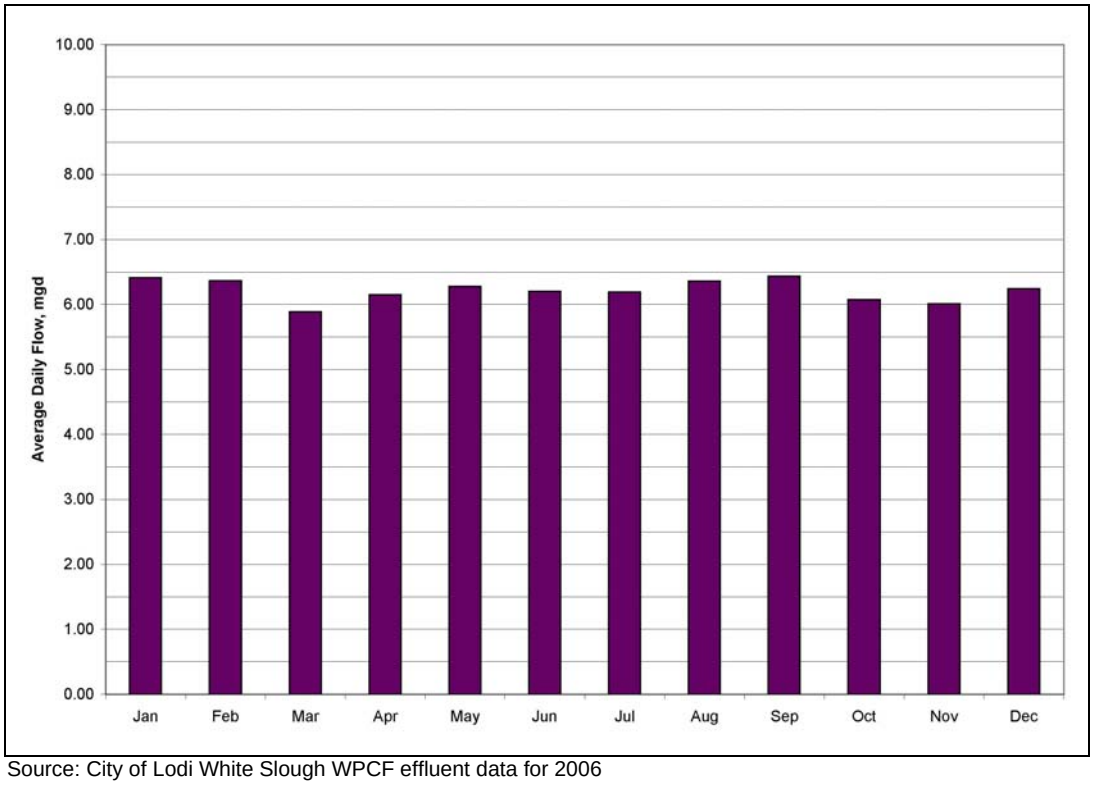
planning horizon to be approximately 25 years with the build out occurring in the year 2030, the peak supply is expected to be 8.5 mgd.

**Table 8: Recycled Water Supply Assumptions**

| Supply Scenario | Average Daily, Available Recycled Water Supply (mgd) |
|---|---|
| 2006 | 6.2 |
| Build out | Up to 8.5[10] |

**T**he average monthly effluent flowrates for the White Slough WPCF are presented in **Figure 3**. Based on these data, no significant seasonal variations in wastewater effluent will be assumed. It will be assumed, however, that a portion of the White Slough WPCF effluent will be seasonally reserved for dilution of blended biosolids and industrial wastewater effluent for land application in the vicinity of the treatment plant – which may effectively result in seasonal limits to the amount of effluent available for a recycled water distribution system. It is assumed that the City/WYA will provide RMC with the quantities of "off limits" municipal wastewater effluent. RMC will coordinate with the City as this information is updated and will incorporate these updates into Market Assessment TM

**Figure 3: 2006 Average Monthly Effluent Flow at White Slough WPCF**




Source: City of Lodi White Slough WPCF effluent data for 2006

[10] West Yost Associates (WYA) is currently assisting the City in a study to determine the amount of municipal wastewater effluent required for dilution of blended biosolids and industrial wastewater effluent, for land application in the vicinity of the WSWPCF. It is assumed that the City/WYA will provide RMC with the quantities of "off limits" municipal wastewater effluent upon completion of the study.

### Flag City

Flag City is a small community located approximately 1 mile north of the White Slough WPCF. The community is currently unsewered, but is involved in discussions with the City of Lodi regarding the feasibility of becoming sewered. If Flag City were to become sewered, its wastewater would be conveyed south to the White Slough WPCF for treatment and disposal. Because the discussions between staff at both the City and Flag City are very preliminary, no additional recycled water supplies will be assumed to be available from a potential connection to Flag City.

### Satellite Treatment (Scalping) Alternatives

Some recycled water systems include satellite treatment, or scalping, of wastewater from upstream sanitary sewers to facilitate treatment at locations closer to potential reuse sites. Evaluation of satellite treatment was in the original scope. The City expressed concern that satellite treatment would be a long term implementation component to the recycled water system in terms of phasing. Therefore, the City staff did not want to evaluate this alternative as part of the RWMP in order to focus on the short term goal of providing RW to potential users in the short term. Due to the WWTP's distance from the City, however, satellite treatment may well prove to be cost effective. Therefore, the City may wish to evaluate it in the future.

## 2.3.2 WID Supplies

Approximately 6,000 acre-feet per year (AFY) of Mokelumne River surface water from the Woodbridge Irrigation District (WID) will be available as a potential source for an interim or blended recycled water supply. According to terms of the contract between the City and WID, the City may divert surface water from this supply between March 1 and October 15, annually. During the months when surface water could be incorporated into the system, surface water would be expected to comprise approximately 41 percent of a blended supply. **Table 9** presents the total demand and the anticipated groundwater and surface water supplies available to meet that demand beginning in 2012.

**Table 9: 2012 Recycled Water Supply Assumptions**

| Month | Total Demand | Groundwater Supply | | Surface Water Supply | |
|---|---|---|---|---|---|
| | AF | AF | % | AF | % |
| Jan | 805 | 805 | 100% | 0 | 0% |
| Feb | 744 | 744 | 100% | 0 | 0% |
| Mar | 978 | 580 | 59% | 398 | 41% |
| Apr | 1307 | 775 | 59% | 532 | 41% |
| May | 1817 | 1077 | 59% | 739 | 41% |
| Jun | 2239 | 1327 | 59% | 911 | 41% |
| Jul | 2454 | 1455 | 59% | 999 | 41% |
| Aug | 2334 | 1384 | 59% | 950 | 41% |
| Sep | 1993 | 1182 | 59% | 811 | 41% |
| Oct | 1621 | 961 | 59% | 660 | 41% |
| Nov | 1015 | 1015 | 100% | 0 | 0% |
| Dec | 895 | 895 | 100% | 0 | 0% |

Additionally, the City has a substantial amount of "banked" WID water, representing the amount of undiverted (paid for) water from years during which this water right was not exercised. Therefore, for approximately the first 10 to 20 years after start up of the City's recycled water distribution system, 6,000 AFY could be treated for potable purposes, while the "banked" water could be used for non-potable uses

and will be evaluated for distribution as an annual amount over several years. The amount of annual distribution of this water will be developed and analyzed as part of the Market Assessment TM.

### 2.3.3 Recycled Water Supply Policy

In the event that the Market Assessment indicates that recycled water demand will exceed the recycled water supply, RMC will work with City staff and discuss the possible development of a City policy for serving recycled water. This policy may include placing limits on the amount of recycled water that the City will commit to serving to the identified users. If necessary, recommendations for such a policy will be documented in the Market Assessment TM. The demand and water supply assessment portions of the RWMP will need to be completed prior to determining whether a policy for serving recycled water is necessary.

## 2.4 Water Quality Assessment

For the purposes of calculating average concentrations of water quality constituents, undetected constituents are assumed to be present at concentrations equal to one-half the detection limit. This assumption is consistent with NPDES reporting guidelines and provides a conservative estimate of water quality concentrations.

Concentrations of each constituent in the current groundwater supply were assumed to be equal to the average concentration of all monitored wells for that constituent. Because different areas within the City receive varying proportions of supply from different wells, water quality concentrations were not weighted by flow rate; all wells are assumed to contribute equally to the overall groundwater concentrations reported herein.

Current recycled water quality is assumed to be equal to reported White Slough effluent water quality.

The quality of WID surface water was estimated to be approximately equal to the average water quality concentrations reported by USGS for monitoring performed on the Mokelumne River at Woodbridge, CA (Station 11325500) from 1973 to 1993. Because the City has not yet conceptualized the surface water treatment process, potential effects of water treatment on drinking water quality could not be estimated, and treated surface water quality was assumed to be approximately equal to untreated surface water quality.

In the future, the City will blend approximately 6,000 AFY of surface water with groundwater. The water quality of this blend is estimated assuming all constituents behave conservatively, and surface water and groundwater are blended at a ratio of 59 percent groundwater to 41 percent surface water from March through October of each year. Section 2.3.2 provides the basis for this assumption. Concentrations of each constituent in the blended drinking water supply will be estimated as follows:

$$C_{blend} = 0.41 * C_{SW} + 0.59 * C_{GW}$$

Where:

$C_{blend}$ = Concentration of constituent in blended supply

$C_{SW}$ = Concentration of constituent in surface water supply

$C_{GW}$ = Concentration of constituent in groundwater supply

To calculate projected recycled water quality following the introduction of surface water into the drinking water supply; it will be assumed that the same percent change in constituent concentrations observed through in the drinking water supply would be observed in the recycled water supply. Concentrations of

each constituent in recycled water quality resulting from the introduction of surface water into the drinking water supply were estimated as follows:

$$C_{RW,blend} = C_{RW,current} * \left(1 - \frac{C_{GW} - C_{blemd}}{C_{GW}}\right)$$

Where:

$C_{RW,blend}$ = Concentration of constituent in recycled water (blended drinking water supply)

$C_{RW,current}$ = Concentration of constituent in current recycled water supply

$C_{GW}$ = Concentration of constituent in groundwater supply

$C_{blend}$ = Concentration of constituent in blended supply

Water Quality data will be presented in detail in the Market Assessment TM.

# 3 Design Criteria

Design criteria will be based on existing City standards provided to RMC, and RMC's experience with similar recycled water planning and design projects. Criterion defined herein is planning level design and will provide the basis to size the proposed facilities and develop reasonable budgetary cost estimates.

## 3.1 Pipeline Design Criteria

For the purpose of completing this analysis and preparing a cost estimate, pipe material will be assumed to be PVC for pipe diameters between 8- and 16-inches and steel for pipe diameters 18-inches and larger. Other pipe materials may be appropriate for this application and should be investigated further during the design phase.

Based on experience with similar sized systems and discussions with City staff, the following criteria will be used.

- Design velocity range: 2 - 10 feet per second
- Minimum delivery pressure of 50 pounds per square inch (psi) during peak hour measured at the transmission main
- Maximum system pressure: 150 psi
- Minimum pipe size: 6-inch
- Head loss to be less than 3 feet per 1,000 feet
- Head loss calculated using Hazen-Williams equation
- Minor head loss: 5% of velocity headloss
- Construction of pipeline to be in existing City right-of-way or Woodbridge Irrigation District easement/right-of-way, where possible

### 3.1.1 Hydraulic Analysis

RMC will construct and analyze a skeletonized hydraulic model of the proposed distribution system using an Excel spreadsheet type format. RMC will create and analyze a minimum of two recycled water system operational scenarios for the most likely pipe alignment to examine near-term and future demand scenarios for sizing of pipeline and storage facilities. These scenarios will be developed and evaluated as part of the Conceptual Alternatives TM.

### 3.1.2 Alignment Alternatives

RMC will develop alternative corridors for the distribution system piping alignment. The development of each alternative will consider potential users to be served, priorities for phased construction, as well as technical issues such as existing locations of major utilities, construction difficulty, and operations and maintenance requirements. RMC will develop and evaluate alignment corridor alternatives during the Conceptual Alternatives TM task. A preliminary utility research will be conducted; however, will be limited to information provided by the City.

## 3.2 Pumping/Storage Facility Design Criteria

Pump stations must be capable of pumping a range of flows based on varying demand. The following design criteria will be used to establish planning level pump station and storage facilities description and cost estimates:

**Pump Stations**

- Construction on City property
- Size for peak hour demands
- Install Variable frequency drives (VFD's)
- No back-up power supply
- One standby pump
- Minimum pump efficiency of 75%
- At least 2 pumps should be the same size

A combination of at least two pumps will be used in the model to deliver the flow. The pumps will be the same size since systems are often designed this way to increase redundancy, maximize even pump use, and maximize commonality of spare parts.

**Storage Tanks**

- Construction on City property or Sites dedicated for pump facilities in future developments
- Storage supply for 50% of peak day demand
- Base of tanks at grade
- Closed steel tanks
- Height < 32-feet to minimize visual impact (30-feet side water depth plus 2-feet of freeboard)

# 4 Cost Criteria

Planning level cost estimates will be developed using the methodology outlined in **Table 10**. A preliminary list of unit costs to be used to estimate raw construction cost is provided in **Table 11**.

**Table 10: Planning Level Cost Estimate Assumptions**

| Project Costs Equation | Assumptions |
|---|---|
| Raw Construction Cost | See **Table 11** for unit costs to be used |
| + Contractor Overhead & Profit | 10% of Raw Construction Cost |
| + Change Order Allowance | 5% of Raw Construction Cost |
| = Subtotal Construction Cost | |
| + Land & Right-of-Way Cost | 0 |
| + Construction Phase Unknown Allowance | 30% of Construction Cost |
| = Subtotal Construction Cost | |
| + Environmental Documentation | 2% of Total Construction Cost |
| + Engineering | 15% of Total Construction Cost |
| + Construction Management | 15% of Total Construction Cost |
| + Administration & Legal | 10% of Total Construction Cost |
| = Total Project Cost | |

**Table 11: Preliminary Unit Cost Assumptions**

| Item | Units | Cost ($) | Description/Assumptions |
|---|---|---|---|
| DISTRIBUTION | | | |
| Open Trench | | | Open trench construction with shoring, resurfacing (assumes paved areas); assumes normal utility congestion. These unit costs are based on recent bids in Northern California. |
| 6”-14” PVC pipe | $/LF | 47 - 150 | |
| 18”-36” Steel pipe | $/LF | 210-400 | |
| Bore and Jack | | | |
| 8”-16” Pipe | $/LF | 600 | These costs should be verified based on recent local bid results. |
| 18”-20” Pipe | $/LF | 750 | |
| 24”-27” Pipe | $/LF | 750 | |
| 30” Pipe | $/LF | 750 | |
| 36” Pipe | $/LF | 900 | |
| VALVES | | | |
| Pressure Reducing Valve | $/unit | 50,000 | An allowance of $50,000 is assumed for pressure reducing valves for 24-inch and 36-inch diameter pipelines. |
| STORAGE | | | |
| Storage Tank | Per Gallon | 0.80 | Above ground, steel tank. This cost is based on recent bids in Northern California; this cost should be verified based on recent local bid results. |
| PUMPING | | | |
| Pump Station | Per gpm and TDH | 290K+1860/hp | Pump Station costs |
| USER CONNECTION | | | |
| Meter & Valves: | | | Costs based on City of Roseville Master Plan – Recycled Water Distribution System Feasibility Study (2000). |
| User Demand (afy) | | | |
| <10 | $/User | 10,000 | |
| >10 | $/User | 50,000 | |
| Lateral from Backbone | $/LF | 50 | Assume all laterals to be 6” diameter for cost estimates |
| O&M | | | |
| Storage Tank Maintenance | $/Year | 72 | Assumes 60 hours of labor per MG per year |
| Distribution System Maintenance | % | 1% | 1% of total pipeline construction costs |
| Pump Station: | | | |
| Operation Cost | Kwh | 0.12 | |
| Maintenance Cost | % | 15% | 15% of pump station capital costs. |
| OTHER | | | |
| ENR CCI Index | - | 8490 | Average between 20 Cities and San Francisco February 2007 index |
| Life-cycle Interest Rate | % | 5.50% | |
| Life-cycle Period | Years | 25 | |
| Land & Right-of-Way | $/Acres | | Assumes all project facilities will be constructed on City land. |

# ATTACHMENT A

## RECYCLED WATER USES ALLOWED IN CALIFORNIA

**RECYCLED WATER USES [A] ALLOWED IN CALIFORNIA**

| | Treatment Levels | | | |
|---|---|---|---|---|
| **Irrigation** | **Disinfected Tertiary Recycled Water** | **Disinfected Secondary-2.2 Recycled Water** | **Disinfected Secondary-23 Recycled Water** | **Un-disinfected Secondary Recycled Water** |
| Food crops where recycled water contacts the edible portion of the crop, including all root crops | **Allowed** | Not allowed | Not allowed | Not allowed |
| Parks & playgrounds | **Allowed** | Not allowed | Not allowed | Not allowed |
| School yards | **Allowed** | Not allowed | Not allowed | Not allowed |
| Residential landscaping | **Allowed** | Not allowed | Not allowed | Not allowed |
| Unrestricted access gold courses | **Allowed** | Not allowed | Not allowed | Not allowed |
| Any other irrigation uses not prohibited by other provisions of the California Code of Regulations | **Allowed** | Not allowed | Not allowed | Not allowed |
| Food crops where edible portion is produced above ground and not contacted by recycled water | **Allowed** | **Allowed** | Not allowed | Not allowed |
| Cemeteries | **Allowed** | **Allowed** | **Allowed** | Not allowed |
| Freeway landscaping | **Allowed** | **Allowed** | **Allowed** | Not allowed |
| Restricted access golf courses | **Allowed** | **Allowed** | **Allowed** | Not allowed |
| Ornamental nursery stock and sod farms | **Allowed** | **Allowed** | **Allowed** | Not allowed |
| Pasture for milk animals | **Allowed** | **Allowed** | **Allowed** | Not allowed |
| Non-edible vegetation with access control to prevent use as a park, playground or school yard | **Allowed** | **Allowed** | **Allowed** | Not allowed |
| Orchards with no contact between edible portion and recycled water | **Allowed** | **Allowed** | **Allowed** | **Allowed** |
| Vineyards with no contact between edible portion and recycled water | **Allowed** | **Allowed** | **Allowed** | **Allowed** |
| Non food-bearing trees, including Christmas trees not irrigated less than 14 days before harvest | **Allowed** | **Allowed** | **Allowed** | **Allowed** |
| Fodder crops (e.g. alfalfa) and fiber crops (e.g. cotton) | **Allowed** | **Allowed** | **Allowed** | **Allowed** |
| Seed crops not eaten by humans | **Allowed** | **Allowed** | **Allowed** | **Allowed** |
| Food crops that undergo commercial pathogen-destroying processing before consumption by humans | **Allowed** | **Allowed** | **Allowed** | **Allowed** |
| Ornamental nursery stock, sod farms not irrigated less than 14 days before harvest | **Allowed** | **Allowed** | **Allowed** | **Allowed** |

**RECYCLED WATER USES [A] ALLOWED IN CALIFORNIA**

| Other Uses | Treatment Levels | | | |
|---|---|---|---|---|
| | **Disinfected Tertiary Recycled Water** | **Disinfected Secondary-2.2 Recycled Water** | **Disinfected Secondary-23 Recycled Water** | **Un-disinfected Secondary Recycled Water** |
| Groundwater recharge | Allowed under special case-by-case permits by RWQCBs [b] | | | |
| Flushing toilets & urinals | **Allowed** | Not allowed | Not allowed | Not allowed |
| Priming drain traps | **Allowed** | Not allowed | Not allowed | Not allowed |
| Landscape impoundments without decorative fountains | **Allowed** | **Allowed** | **Allowed** | Not allowed |
| Industrial and commercial cooling or air conditioning involving cooling tower, evaporative condenser, or spraying that creates a mist | **Allowed** [c] | Not allowed | Not allowed | Not allowed |
| Industrial process water that may contact workers | **Allowed** | Not allowed | Not allowed | Not allowed |
| Structural fire fighting | **Allowed** | | | Not allowed |
| Nonstructural fire fighting | **Allowed** | **Allowed** | **Allowed** | Not allowed |
| Decorative fountains | **Allowed** | Not allowed | Not allowed | Not allowed |
| Consolidation of backfill material around potable water pipelines | **Allowed** | Not allowed | Not allowed | Not allowed |
| Backfill consolidation around nonpotable piping | **Allowed** | **Allowed** | **Allowed** | Not allowed |
| Soil compaction | **Allowed** | **Allowed** | **Allowed** | Not allowed |
| Mixing concrete | **Allowed** | **Allowed** | **Allowed** | Not allowed |
| Dust control on roads and streets | **Allowed** | **Allowed** | **Allowed** | Not allowed |
| Cleaning roads, sidewalks, and outdoor work areas | **Allowed** | **Allowed** | **Allowed** | Not allowed |
| Flushing sanitary sewers | **Allowed** | **Allowed** | **Allowed** | **Allowed** |

(a) Refer to the full text of the latest version of Title-22: California Water Recycling Criteria. This chart is only a guide to the June 2001 version.
(b) Refer to Groundwater Recharge Guidelines, California Department of Health Services.
(c) Drift Eliminators and/or biocides are required

# Appendix B Market Assessment TM

# FINAL Technical Memorandum

**City of Lodi Recycled Water Master Plan**

| | |
|---|---|
| **Subject:** | **Recycled Water Market Assessment** |
| **Prepared For:** | Lyman Chang |
| **Prepared by:** | Andy Smith (RMC)<br>Deana Donohue (RMC) |
| **Reviewed by:** | Helene Kubler (RMC)<br>Dave Richardson (RMC) |
| **Date:** | August 3, 2007 |
| **Reference:** | 0140-003.02 |

## 1 Introduction

This technical memorandum (TM) presents the results of the Recycled Water Market Assessment (Market Assessment) conducted as part of the City of Lodi Recycled Water Master Plan (RWMP). The City's Recycled Water Service Area (Service Area or RWSA) is shown in **Figure 1**. The City's Service Area was originally defined in the *City of Lodi Water Recycling Facilities Planning Grant Application, September 2006*, and was subsequently updated for this project. This project was conducted for a planning horizon from the current year (2007) to a potential buildout in the year 2030.

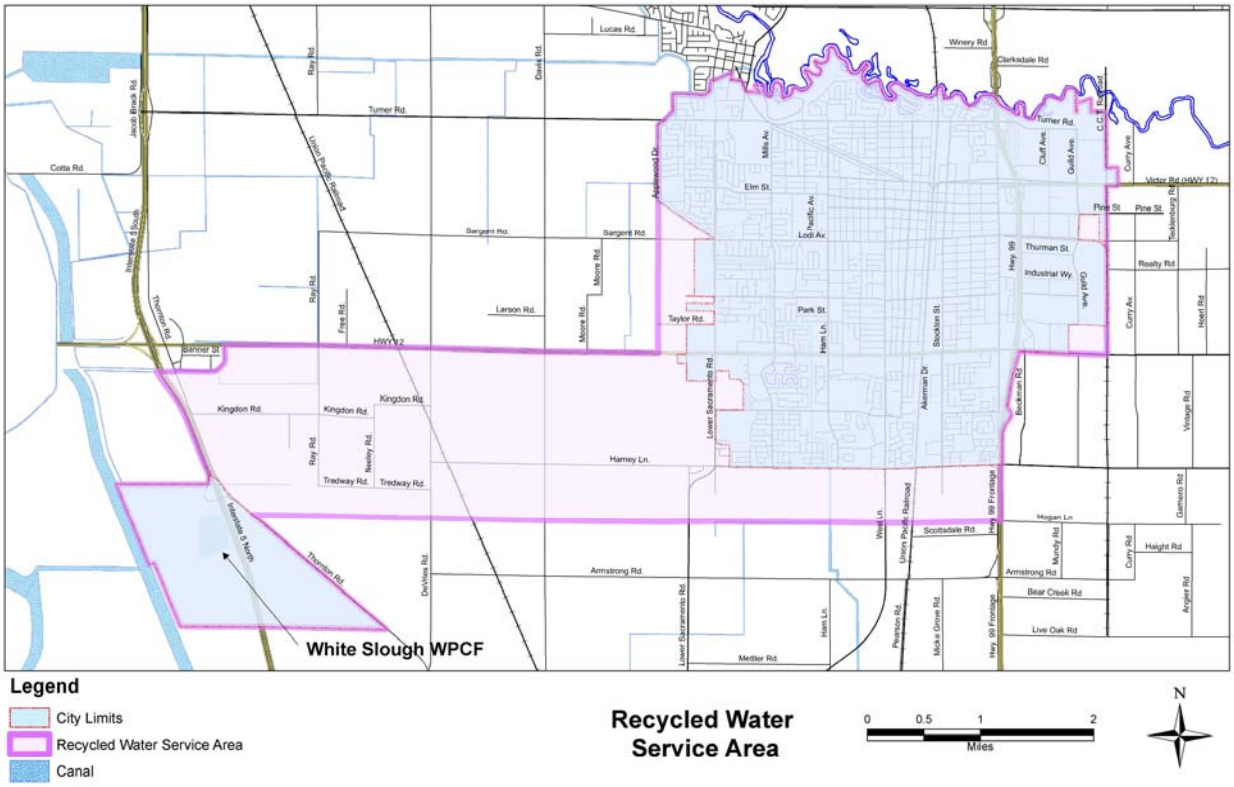
The purpose of the Market Assessment was to identify specific potential urban, commercial, industrial, and agricultural recycled water users within the RWSA and estimate recycled water demands for these users. The results presented in this TM will provide the basis for the subsequent development and evaluation of project alternatives, the development of recommended projects, and the preparation of an implementation plan.

The Market Assessment data analyzed as part of this task were based on a review of readily available and relevant documents, City-provided Geographic Information System (GIS) data[1], discussions with City staff, and RMC's experience with similar recycled water projects. The documents reviewed during the Market Assessment are as follows:

- City of Lodi 1989 General Plan[2];
- City of Lodi 2005 Urban Water Management Plan, *April 2006 (RMC)*;
- City of Lodi Wastewater Master Plan, *January 2001 (West Yost Associates)*;
- Joint City of Stockton, City of Lodi Effluent Disposal and Reuse Study, *October 2004 (West Yost Associates)*
- Lodi White Slough WPCF Soil and GW Investigation Existing Conditions Report, *September 2006 (West Yost Associates);* and,
- City of Lodi Park, Recreation, and Open Space Plan, *January 1994*.

[1] Includes aerial photography, parks, schools, parcels, and zoning information.
[2] The City is in the process of updating its General Plan. The 1989 General Plan's planning horizon extends to 2007.

**Figure 1: Recycled Water Service Area**




Key methodology and design assumptions were developed prior to the Market Assessment and documented in the *Key Assumptions TM*, dated April, 2007. The key design assumptions were used as a guideline for evaluating the potential recycled water users.

This TM is divided into the following sections:

1 Introduction
2 Recycled Water User Identification
3 Recycled Water Demand Assessment
4 Water Supply Assessment
5 Water Quality Assessment
6 Conclusions

# 2 Recycled Water User Identification

This section presents and summarizes the potential urban, commercial, industrial, and agricultural recycled water users identified within the RWSA. Allowable uses within the RWSA considered as part of the Market Assessment are listed in **Table 1**. Refer to the *Key Assumptions TM* in **Attachment A** for a more detailed description of the user categories and/or subcategories summarized in Table 1.

The potential users identified in the Market Assessment are summarized in Section 2.4. Sections 2.1, 2.2, and 2.3 present additional information about the identification of potential urban; commercial and industrial; and agricultural users, respectively. **Table B-1** in **Attachment B** presents a detailed list of all identified users, their land use categories, names (where applicable), gross and net irrigable acreages, and their estimated recycled water demands.

**Table 1: Allowable Recycled Water Uses within the RWSA**

| Type of Use | Category | Subcategory | Comments |
|---|---|---|---|
| Irrigation | Urban | Basins/Parks and Playgrounds | • Wilderness" areas (e.g., Mokelumne River Wilderness) will not be assumed to be irrigable, with the exception of a portion of the Lodi Lake Park & Wilderness Area. |
| | | Schools | • Location of existing schools are included in the GIS data provided by the City<br>• The Delta College facilities will not be served by the Lodi recycled water system based on the facilities' remote location in relation to other likely users |
| | | Median Strips/Freeway Landscaping | • The total area for existing highway and freeway median strips includes the area between the inner shoulders of both directions.<br>• Parts of Highway 99 feature such median strips.<br>• Highway 12 and Interstate 5 do not feature such median strips within the RWSA. |
| | | Cemeteries | |
| | | Golf Courses | There are no existing or planned golf courses in the RWSA |
| | Agricultural | Food Crops | |
| | | Orchards | |
| | | Vineyards | |
| | | Ornamental Nursery | Potential users include Mainland Nursery, located at the intersection of the WID main canal and Turner Road |
| | | Sod Farms | |
| Other Uses | Industrial | Process water | |
| | | Cooling | |
| | Commercial | Toilet Flushing | |
| | | Cooling | |
| | Municipal | Dust control | Department of Public Works and contractors would be main users |
| | | Sewer flushing | Department of Public Works would be main user |

## 2.1 Urban Recycled Water Users

The potential urban users identified in the City's Service Area are shown in **Figure 2**. The potential urban users include: parks, storm water detention basins, an artificial lake, cemeteries, schools and other institutions, and median strips. Potential recycled water uses that may apply to these users include irrigation of vegetation. Potential recycled water uses that were not enumerated at this time include: toilet flushing in public buildings; dust control; sewer flushing; decorative fountains; commercial laundry; and automatic car washes. These uses do not appear in Figure 2.

## 2.2 Commercial & Industrial Recycled Water Users

**Figure 3** presents the locations of potential commercial and industrial facilities recycled water users in the City's Service Area. The existing commercial and industrial facilities identified as potential recycled water users include: an existing Northern California Power Agency (NCPA) power plant, San Joaquin County Vector & Mosquito Control District (SJCV&MCD) fish rearing ponds, Certainteed, and Mainland

Nursery. The potential future facilities include an additional NCPA power plant, a Blue Shield Call Center in the Reynolds Ranch development area, and undeveloped commercial and industrial areas. Potential recycled water uses that may apply to these users include: landscape irrigation, industrial process water, operational water, air conditioning and/or toilet flushing in new commercial and industrial developments, or other uses not identified at the time of this study. It should be noted that some of the currently undeveloped commercial and industrial areas may in fact be developed prior to the implementation of the RWMP. Determination of those currently undeveloped commercial and industrial areas that could reasonably be served recycled water in the future will be made during the development of the Conceptual Alternatives, and presented in the Conceptual Alternatives TM. Additional information about specific potential industrial and commercial users identified in the RWSA is provided in **Table 2**.

**Table 2: Potential Major Industrial and Commercial Users**

| User Name | Use Category | Existing? | Comment |
|---|---|---|---|
| Certainteed | Industrial | Y | |
| Mainland Nursery | Industrial | Y | |
| NCPA Power Plant | Industrial | | |
| Existing Plant | | Y | The existing NCPA power plant facility, located adjacent to WSWPCF, may obtain Title 22 certification in the future. If Title 22 certification is obtained, secondary treated effluent could be provided to the facility instead of tertiary treated effluent (WYA, 2006). For the purposes of the RWMP, however, it will be assumed that the existing NCPA facility will continue to require tertiary treated effluent. The existing NCPA plant is used for peaking power only. |
| New Plant | | N | A new base-load NCPA power plant will be considered as a potential recycled water customer for this RWMP, based on discussions with City staff. Normal and peak demands of 1.7 mgd and 2.5 mgd, respectively, will be assumed for the facility. The facility is anticipated to be operational in 2012. |
| SJCV & MCD Fish Rearing Ponds | Industrial | Y | |
| Blue Shield Call Center | Commercial | N | The Blue Shield Call Center will use recycled water supplied by the City for landscape irrigation. The building/call center will be located in the southeastern corner of the Reynolds Ranch development, will comprise about 20 acres, and will be complete in 2008 |

Source: City input (January 2007)

## 2.3 Agricultural Recycled Water Users

Potential agricultural users identified in the City's Service Area are shown in **Figure 4**. The anticipated recycled water use for all agricultural users is crop irrigation.

## 2.4 Potential User Summary

The potential recycled water users identified for this Master Plan are shown in **Figure 5**. As discussed above, **Table B-1** in **Attachment B** presents a detailed list of all identified users, their land use

categories, names (where applicable), gross and net irrigable acreages, and their estimated recycled water demands.

**Table 3: Summary of Potential Recycled Water Users**

| User Category | User Subcategory | Gross Acreage |
|---|---|---|
| **Urban** | Parks | 351 |
| | Lake | 18 |
| | Cemeteries | 56 |
| | Schools | 319 |
| | Median Strips | 18 |
| | **Subtotal** | **762** |
| **Commercial & Industrial** | Undeveloped Commercial | 117 |
| | Undeveloped Industrial | 263 |
| | Specific/Major Commercial | 22 |
| | Specific/Major Industrial | 100 |
| | **Subtotal** | **502** |
| **Agricultural** | Vineyards | 1,768 |
| | Orchards | 581 |
| | Miscellaneous Field Crops | 1,862 |
| | **Subtotal** | **4,211** |
| | **TOTAL** | **5,475** |

**Figure 2: Potential Urban Recycled Water Users**

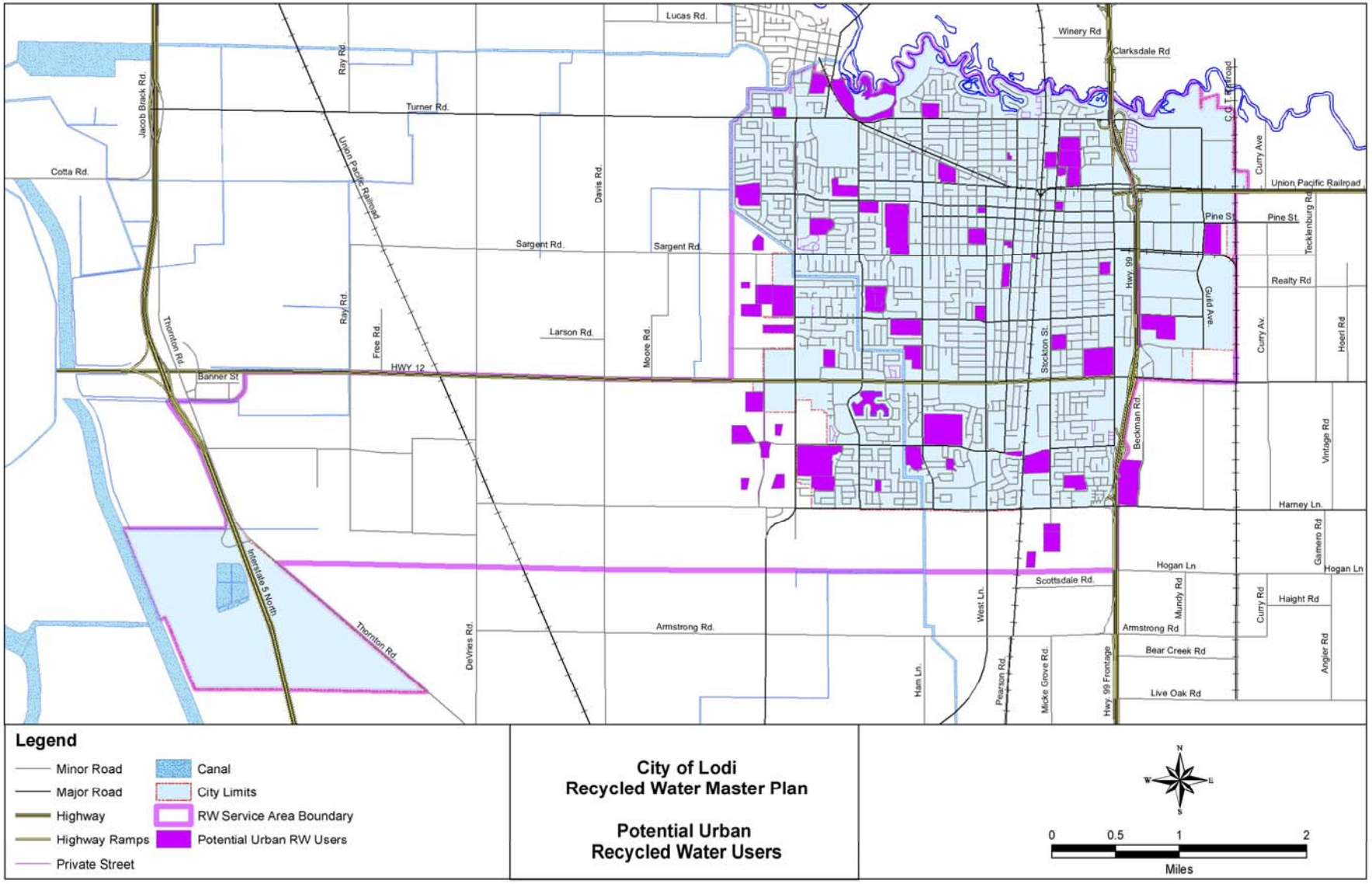


**Figure 3: Potential Commercial & Industrial Recycled Water Users**

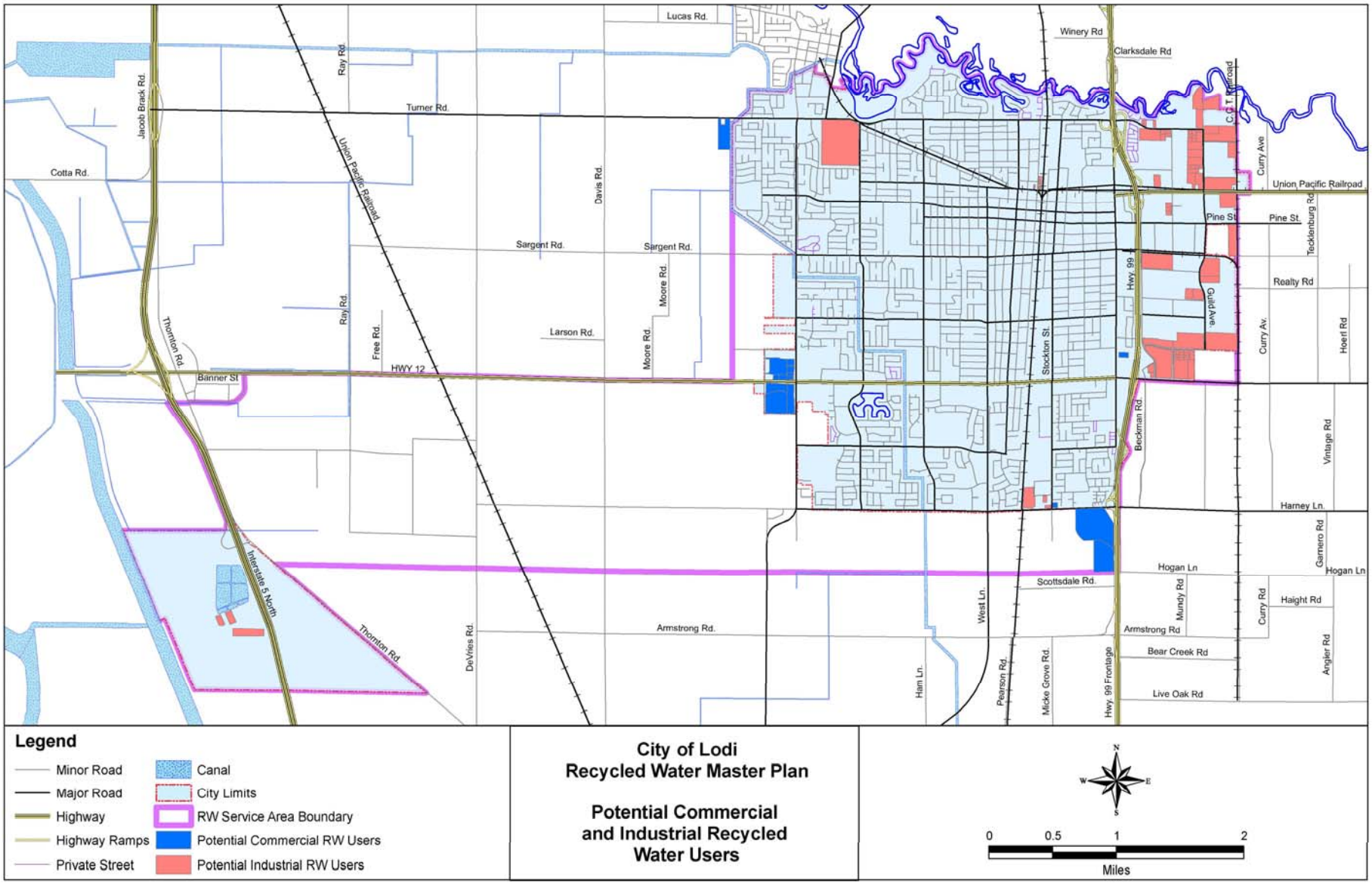


**Figure 4: Identified Potential Agricultural Recycled Water Users**

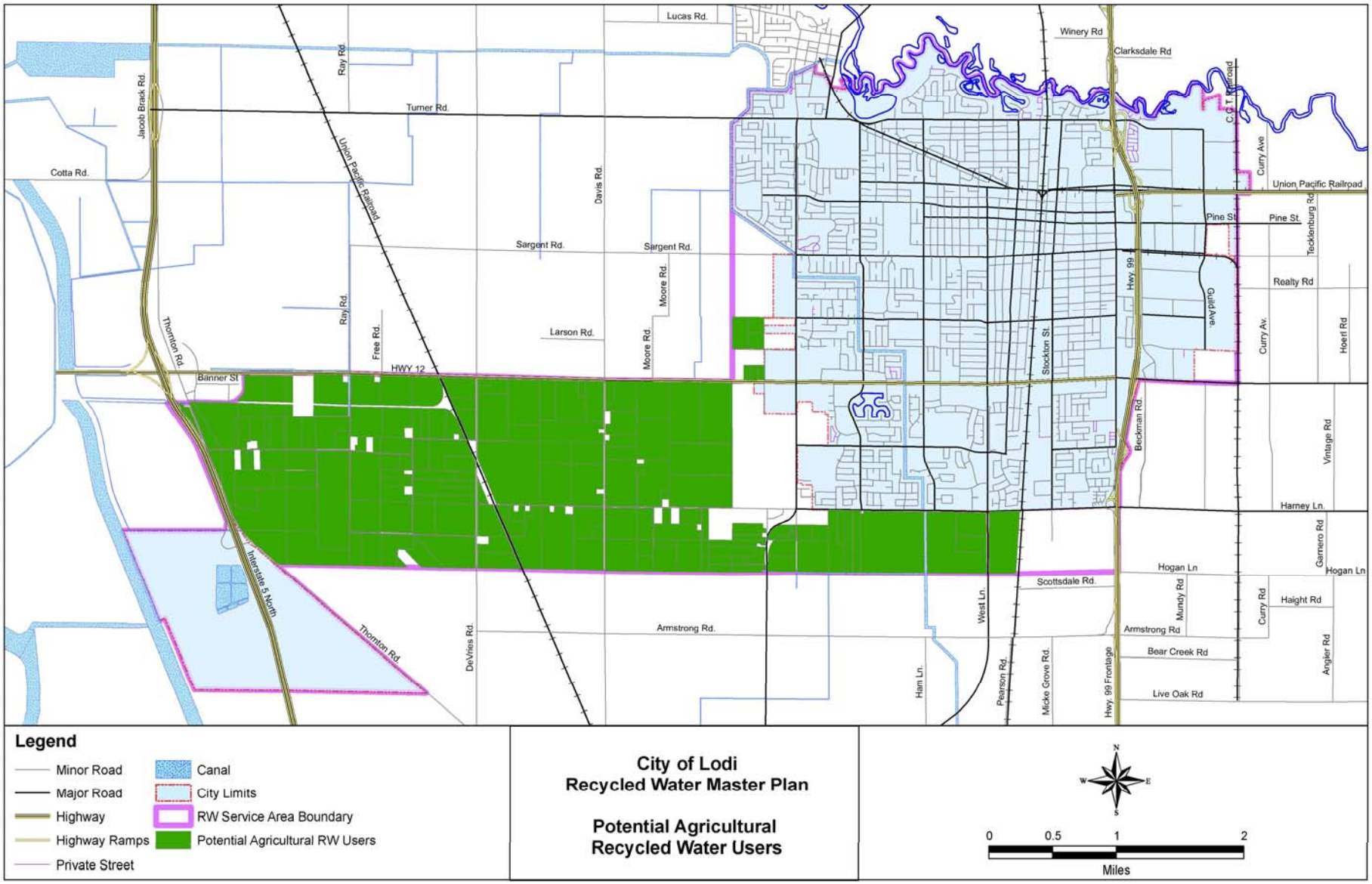
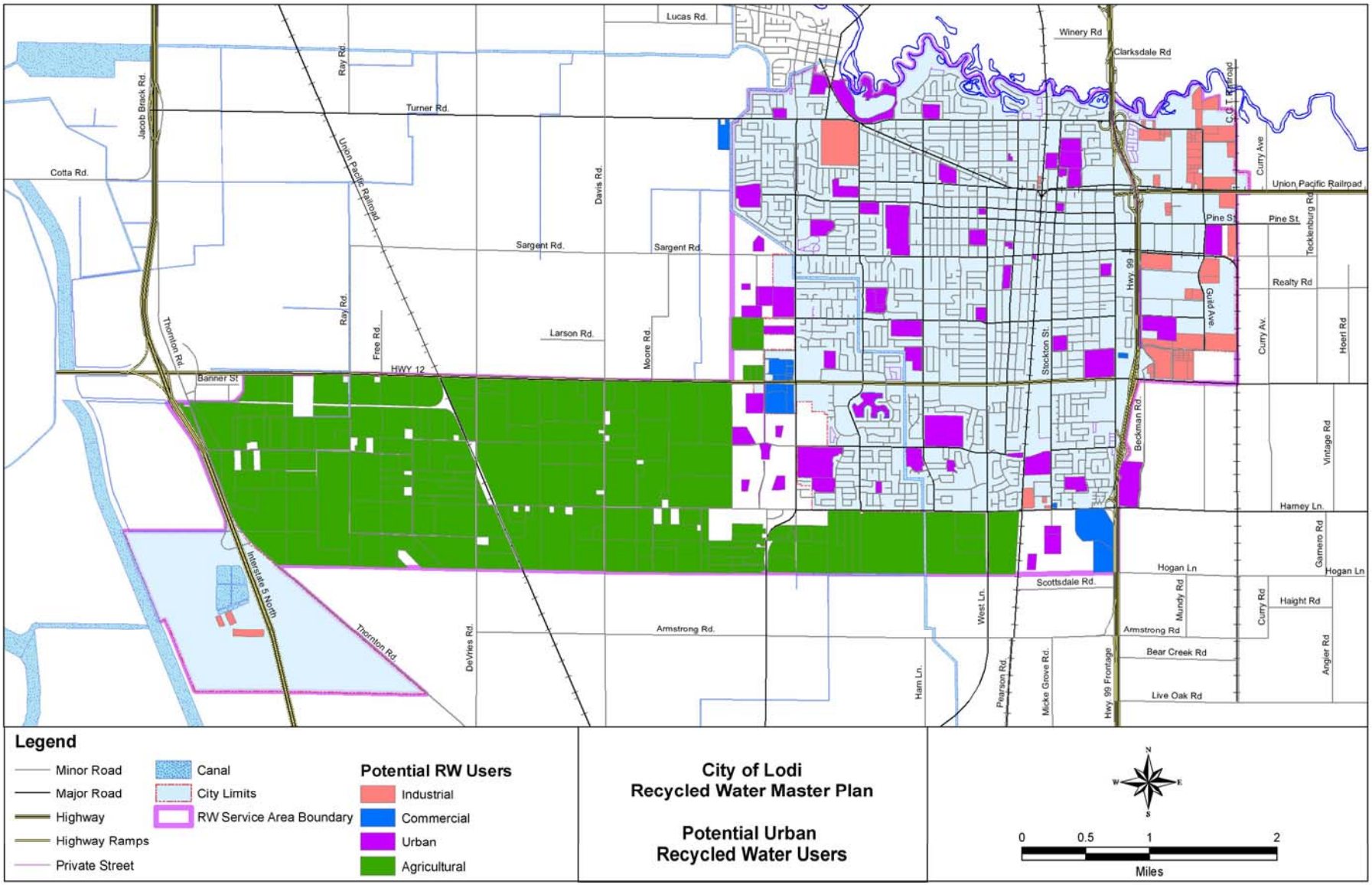


**Figure 5: Summary of Potential Recycled Water Users**



# 3 Recycled Water Demand Assessment

## 3.1 Recycled Water Demand Estimate Methodologies

The recycled water demands for the potential recycled water users were determined according to the demand estimate methodologies presented in the *Key Assumptions TM* (April 2007) and summarized in **Table 4** and the paragraphs below. The methodologies applied to each of the user subcategories are presented in **Table 6**.

**Table 4: Summary of Demand Estimate Methodologies**

| Methodology | Application |
|---|---|
| Methodology A | Used to determine irrigation demand based on available water use data |
| Methodology B | Used to determine irrigation demand based on landscape-specific crop coefficient and evapotranspiration data when water use data is not available |
| Methodology C | Used to determine irrigation and non-irrigation demands based on water usage factors when water use data and acreage irrigated are not available |
| Methodology D | Used to develop demand estimates when direct input is available from individual users or the City |

### Methodology A – Irrigation Demand Based on Water Use Data

Methodology A was used to determine irrigation demand (ID) for potential recycled water users with available metered water use data. Available meter data for potential users, which were provided by the City, are included in **Attachment C**. Assumptions were made about the percentage of the metered water that was used specifically for irrigation in the event that meter data for irrigation purposes only were not available. Refer to the *Key Assumptions TM* (Attachment A) for the equations used with Methodology A, and for further discussion of the assumptions made.

### Methodology B – Irrigation Demand based on Landscape/Crop Coefficient Data

Methodology B was used to determine the irrigation demands of potential recycled users without available metered water use data. Area-specific evapotranspiration ($ET_o$) data were obtained using California Irrigation Management Information System (CIMIS) data for a location near the City of Lodi (there is one active CIMIS station in the City's vicinity, and one inactive station). The closest active station is Station #166 (Lodi West); the $ET_o$ used for this study is from Station #166. Data from the California Polytechnic State University, San Luis Obispo Irrigation Training and Research Center (ITRC) were used in the determination of evapotranspiration rates for non-turfgrass crops (i.e., vineyards, orchards, and miscellaneous field crops).

**Attachment C** includes the values of crop coefficients, evapotranspiration, precipitation, infiltration, leaching rate factors, and irrigation efficiencies that were used with to develop monthly unit irrigation demands for the Lodi area. Refer to the *Key Assumptions TM* (Attachment A) for the equations used with Methodology B, and for further discussion of the assumptions made.

### Methodology C – Irrigation and Non-Irrigation Demands based on Water Usage Factors

Methodology C was used to determine the potential future irrigation and non-irrigation demands for undeveloped residential, commercial and industrial areas. Demands were determined by multiplying the water use factor (WUF) specific to each potential user's land use classification by a percentage assumed to represent the amount of total water demand that may be met with recycled water. Refer to the *Key*

*Assumptions TM* (Attachment A) for the equations used with Methodology C, and for further discussion of the assumptions made.

This methodology is considered acceptable for the purposes of this Master Plan given available information, and because only the backbone system will be developed. When designing the local system necessary to serve the specific users, however, the demand estimates derived from Methodology C should be refined, and a local "master plan" should be prepared by the City and/or the developers.

## Methodology D – Direct Input

Methodology D, which requires direct input (from the user, the City, or both) on estimated recycled water demands, has been used for a number of specific potential industrial and commercial users. A summary of the potential industrial and commercial recycled water users in this category is presented in **Table 5**.

It should be noted that prior to the Recycled Water Feasibility Workshop/Large User Meetings conducted as part of the preparation of this Master Plan, demand estimate "placeholders" for several of the potential users in Table 5 have been developed using Methodology C.

**Table 5: Major Industrial and Commercial Users**

| Potential User | Source of Demand Information |
|---|---|
| Blue Shield Call Center | TBD [a] |
| Certainteed | TBD [a] |
| Mainland Nursery | TBD [a] |
| Existing NCPA Power Plant | City |
| Future Potential NCPA Plant | City |
| SJCV & MCD Fish Rearing Ponds | City |
| City of Lodi Public Works | City |

Footnote:
a. At the submittal of this TM, demand estimate has been developed using Methodology C.

**Table 6: User-Specific Application of Demand Estimate Methodologies**

| Type of Use | Category | Use Subcategory or User Name | Metered Water Use? | Direct Input? | Demand Estimate Methodology Applied |
|---|---|---|---|---|---|
| Irrigation | Urban | Basins/Parks or Playgrounds - Existing | Y | N | A |
| | | Schools Existing/Undeveloped | Y/N | N | A/B |
| | | Median Strips/Freeway Landscaping - Existing | Y | N | A |
| | | Cemeteries - Existing | N | N | B |
| | | Basins/Parks or Playgrounds – Existing/Undeveloped | N | N | B |
| | | Landscape Irrigation in Commercial Areas- General Undeveloped | N | N | C |
| | | Landscape Irrigation in Industrial Areas - General Undeveloped | N | N | C |
| | | Mainland Nursery | N | N | B |
| | | Other Uses - City of Lodi Public Works | N | Y | D |
| | Agricultural | Vineyards – Existing | N | N | B |
| | | Orchards – Existing | N | N | B |
| | | Miscellaneous Field Crops - Existing | N | N | B |
| Irrigation and Non-Irrigation | Industrial | Certainteed | N | Y | D |
| | | NCPA Power Plant | Y | Y | D |
| | | SJCV & MCD Fish Rearing Ponds | Y | Y | D |
| | | Potential NCPA Plant | N | Y | D |
| | | Industrial - General Undeveloped | N | N | C |
| | Commercial | Blue Shield Building | N | Y | C |
| | | Commercial - General Undeveloped | N | N | C |

## 3.2 Peak Day and Peak Hour Demands

Peak day and peak hour demands for potential users were calculated according to the equations presented in the *Key Assumptions TM* (Attachment A). The peak day and peak hour peaking factors used for these equations are presented in **Table 7**. Non-irrigation uses of recycled water (e.g., toilet flushing, industrial process water, etc.) do not always experience seasonal or diurnal fluctuations in demand. For this reason, the estimated demands associated with undeveloped commercial and industrial areas, which include both irrigation and non-irrigation components, were peaked conservatively, as if the demands were solely irrigation-based. Peak day and peak hour demands for major potential industrial and commercial users were determined on a case-by-case basis.

**Table 7: Peak Day and Hour Peaking Factors**

| Type of Use | Peak Day Peaking Factor | Peak Hour Peaking Factor |
|---|---|---|
| Irrigation: Miscellaneous Field Crop | 4.7 [a] | 2.0 |
| Irrigation: Orchard | 2.7 [a] | 2.0 |
| Irrigation: Vineyard | 3.1 [a] | 2.0 |
| Irrigation: Turf Grass [b] | 2.3 [a] | 3.0 |
| Irrigation: Turf Grass - Parks | 4.0 [c] | 2.0 |
| Irrigation: Undeveloped Commercial and Industrial Areas | 2.3 [a,d] | 3.0 |
| Non-Irrigation Uses | -- [e] | -- [e] |

Footnote:

a. Based on information presented in **Attachment C**.
b. For all turfgrass irrigation areas other than City parks.
c. Assumed peaking factor, based on discussions with City staff in May 2007. Although current (May 2007) peaking factors at City parks are higher, the City intends to reevaluate its park irrigation practices in the future.
d. Assumes irrigation of turfgrass.
e. Peak day and peak hour peaking factors determined on a case-by-case basis. Refer to **Attachment C**.

## 3.3 Potential Recycled Water Demands

A summary of the potential recycled water demands for the users identified in Section 2, which were calculated according the methodologies and assumptions discussed in Section 3.1, are presented in **Table 8**. The total estimated annual demands for potential urban; commercial and industrial; and agricultural users are approximately 1,750 AFY, 1,850 AFY, and 9,150 AFY, respectively. A summary analysis of these demands is presented in Section 3.5.

**Table 8: Summary of Potential Recycled Water Demands [a]**

| User Category | User Subcategory | ADD (afy) | ADD (mgd) | PDD (mgd) | PHD (gpm) | PHD (mgd) |
|---|---|---|---|---|---|---|
| Urban [b] | Parks | 1,009 | 0.73 | 2.92 | 4,057 | 5.84 |
| | Lake | 70 | 0.06 | 0.15 | 203 | 0.29 |
| | Cemeteries | 161 | 0.14 | 0.34 | 466 | 0.67 |
| | Schools | 414 | 0.31 | 0.73 | 1,019 | 1.47 |
| | Median Strips | 61 | 0.03 | 0.06 | 90 | 0.13 |
| | **Subtotal** | **1,731** | **1.29** | **4.24** | **6,419** | **9.24** |
| Commercial & Industrial | Undeveloped Commercial | 16 | 0.01 | 0.03 | 46 | 0.07 |
| | Undeveloped Industrial | 32 | 0.03 | 0.07 | 94 | 0.14 |
| | Specific/Major Commercial [c] | 37 | 0.03 | 0.08 | 158 | 0.23 |
| | Specific/Major Industrial [d] | 1,745 | 2.33 | 3.10 | 2,576 | 3.71 |
| | **Subtotal** | **1,831** | **2.41** | **3.28** | **2,874** | **4.14** |
| Agricultural | Vineyards | 3,900 | 3.48 | 10.75 | 14,937 | 21.51 |
| | Orchards | 1,758 | 1.57 | 4.27 | 5,924 | 8.53 |
| | Miscellaneous Field Crops | 3,476 | 3.10 | 14.44 | 20,061 | 28.89 |
| | **Subtotal** | **9,134** | **8.15** | **29.46** | **40,922** | **58.93** |
| | **TOTAL** | **12,696** | **11.85** | **36.98** | **50,215 [e]** | **72.31 [e]** |

Footnotes:

a. Demand estimate methodology varies depending on available information, and category and type of uses. The City should update demand estimates for undeveloped commercial and industrial areas as more specific information for each new development area (e.g., specific land use type and/or water demand projections) becomes available. Demand estimate updates could be part of the preparation of specific plans associated with each new development.

b. Urban demand estimates do not include the following uses/users:
   - Small urban uses (e.g., toilet flushing in public buildings, decorative fountains, automatic commercial car washes). These uses should be considered as part of the design phase of the recommended recycled water projects.
   - Structural fire fighting. This use was not included.
   - Dust control. No data was available on water usage. It is assumed that fill station(s) would be installed along the recycled water backbone system to serve this use.
   - Sewer flushing. Demand information has not been developed at this time. It is assumed that fill station(s) could be installed along the recycled water backbone system to serve this use.

c. Includes Blue Shield Mainland Nursery.

d. Includes NCPA power plants; SJCV & MCD Fish Rearing Ponds; and Certainteed for average demands. For peak day and peak hour demands, existing NCPA power plant is not included, as the City anticipates that upon construction of the future base load NCPA plant, use of the existing peaking plant will diminish. Additional discussion regarding this assumption will be included in the Conceptual Alternatives TM.

e. Although peak hour demands are totaled, the peak usage periods for different user subcategories are expected to vary. Peak hour demands may be met with storage, the necessity and/or feasibility of which will be determined during the development of Conceptual Alternatives.

Potential recycled water demands not included in Table 8, including small urban uses, dust control, and sewer flushing, may be identified and incorporated during the design phase of recycled water projects recommended in the City's Recycled Water Master Plan, or during subsequent updates to the Master Plan itself.

## 3.4 User Interest and Barriers to Use

Major issues related to receiving recycled water will be confirmed through discussions with potential recycled water users. Based on RMC's experience with recycled water projects in other settings these issues can typically be categorized into three categories:

1. Perceived human health effects and user-based recycled water quality needs;
2. Delivery pressure and reliability; and,
3. Funding for on-site retrofits and other capital improvements and recycled water rates.

### Perceived Human Health Effects and User-Based Water Quality Needs

Recycled water produced at the White Slough WPCF must meet a number of quality requirements set in Title 22 to protect public health.

Addressing user concerns about health protection in case of ingestion or occasional contact typically involves a series of measures, including clear signage warning that recycled water is not for drinking purposes, as well as a public awareness program to communicate with the public about recycled water and its use.

The quality of the recycled water relative to user-based needs (above and beyond public health considerations) is another typical concern. The constituents found in the recycled water produced at White Slough WPCF, as well as the potential impacts of the application of recycled water within the City's RWSA, are presented in Section 5 below.

To mitigate potentially negative impacts of recycled water application, implementation of best management practices (e.g., reduction of fertilizer application, annual flushing of irrigation systems with potable water to leach salts to the deeper vadose zone, etc.) should be considered on a case-by-case basis.

The quality of recycled water relative to uses other than irrigation, in particular for industrial process water or cooling, should be considered on a case-by-case basis as the needs greatly vary from one customer to another.

### Delivery Pressure and Reliability Needs

Potential recycled water users will likely anticipate delivery pressure that would match the current delivery pressures of the water system. This issue can be addressed during the planning and design phase of the recycled water facilities. Preliminary Design Criteria for the proposed recycled water system are summarized in the *Key Assumptions TM*, dated April, 2007.

Reliability needs should be considered during the design phase of the recycled water facilities, after the City establishes an appropriate level of service for its customers. However, reliability is considered less of a critical issue for irrigation users than for a power plant, for example. Lodi is located in an area that experiences dry, hot summers, and availability of water remains a concern even for irrigation users. Recycled water production needs to meet strict regulatory standards; there is a potential, therefore, for the White Slough WPCF to cease production and/or distribution of recycled water for a period of time in the event of a plant upset. At that time, the City would need to rely on operational storage, located either at the treatment plant on in the distribution system, to provide continuous service to its customers. The amount of operational storage to be provided will be developed and presented in the *Conceptual Alternatives TM*.

### Funding for On-Site Retrofits and Recycled Water Rates

Potential recycled water users may also have concerns about the cost of converting facilities or building new facilities to allow the use of recycled water, and/or about the price of recycled water as it compares to current potable water rates, a concern which may be exacerbated for users that have their own wells.

These matters will need be carefully considered by RMC and the City in order to balance the need to recover the City's costs with the advantages of pricing the water attractively (or providing other incentives) to potential users. Potential funding and/or financing options will be presented and discussed in the RWMP document.

## 3.5 Demand Assessment Summary

This section presents a summary of the demand assessment based on the analysis performed for the potential market and the projected supply of recycled water available.

### Potential RWMP Demands vs. UWMP Demand Projections

The potential recycled water demands presented in **Table 8** were compared to the *total* projected water demands presented in Table 4-5 of the City's 2005 UWMP (RMC, 2006). The results of the comparison are presented below in **Table 9**. (NOTE: Because the user subcategories developed for this RWMP do not perfectly match the City's UWMP customer classifications, only a subset of the RWMP user subcategories was used in the comparison). As the table indicates, the percentage of total (i.e., potable and non-potable) demands projected in the UWMP that could potentially be met with recycled water are 0%, 25% and 8% for residential, commercial/institutional, and industrial UWMP customer classes, respectively. It is assumed that 100% of the City's landscaping demands for parks and median strips could also be met with recycled water.

**Table 9: Comparison of Potential Recycled Water Demands to UWMP Water Demand Projections**

| **UWMP Customer Class** [a] (UWMP Table 4-5) | **Equivalent RWMP User Subcategories** [a] | **Equivalent UWMP Annual Demand Estimate** [b] (AFY) | **RWMP Potential Annual Demand** (AFY) | **Total UWMP Estimated Demand Potentially Met with Recycled Water** (%) |
|---|---|---|---|---|
| SFR | Undeveloped Residential | 3,454 | 0 | 0% |
| MFR | | 1,299 | | |
| Commercial/ Institutional | Undeveloped Commercial | 1,816 | 16 | 25% |
| | Schools – Existing and Undeveloped | | 431 | |
| | Mainland Nursery | | 3 | |
| Industrial | Undeveloped Industrial | 428 | 32 | 8% |
| | Certainteed | | 3 | |

Footnotes:
a. It is assumed that 100% of the City's landscaping demands for parks and median strips could also be met with recycled water.
b. Includes only new demands from the period 2005-2030.

### Service Plausibility and Elimination of Potential Users

The total annual demands presented in Table 8 (11.8 mgd ADD) may exceed the available supplies presented in Section 4.1, depending on whether the City develops additional seasonal storage facilities. As such, it will likely not be feasible to serve all of the potential demands identified in this Market Assessment. Based on the results of both the Large Users Workshops (see Section 3.6 below), and the

subsequent development of the Conceptual Alternatives for this project, certain potential users will necessarily be excluded from a list of users to be served. Potential users may be eliminated due to a variety of reasons, including proximity to proposed distribution system alignments, costs of retrofit/service, negative perception of recycled water, or incompatible water quality requirements.

### Peak Hour Demands and Storage

It should be noted that the peak hour demands presented in Table 9 may or may not be met with system storage. The necessity and/or feasibility of system storage will be determined during the development of Conceptual Alternatives.

## 3.6 Large Users Workshops

Two "Large Users Workshops" were conducted in June 2007 to provide an overview of the RWMP to potential recycled customers in the City's RWSA, as well as to solicit feedback regarding the appeal and/or suitability of recycled water use by potential customers. Presentation materials and meeting minutes from both the Agricultural and Urban Large Users Workshops are included in **Attachment F**.

# 4 Recycled Water Supply Assessment

This section provides a comparison of the potential recycled water demand and available supply. Additionally, a discussion of delivery pressure and reliability needs, potential user interest, and potential barrier to recycled water use are included in this section.

## 4.1 White Slough WPCF Supply

The White Slough WPCF is the sole source of unblended tertiary disinfected recycled water for the City's recycled water system. In 2006, the White Slough WPCF produced an average tertiary disinfected recycled water flow of approximately 6.2 mgd. For the purposes of this Master Plan, recycled water supplies have been assumed as shown in **Table 10**. Assuming the planning horizon to be approximately 25 years with buildout occurring in the year 2030, the peak supply is expected to be 8.5 mgd. During the growing season, a portion of the City's municipal wastewater effluent is assumed to be required for dilution of blended biosolids and industrial wastewater effluent for land application in the vicinity of the White Slough WPCF. As such, the amount of recycled water that will be available for distribution during this period may be reduced, depending on whether the City develops additional seasonal storage facilities. According to West Yost Associates (WYA), who is assisting the City in this matter, approximately 188 million gallons (MG) will be required during the peak recycled water demand month of July. The corresponding supply available for distribution to the recycled water customers identified in this Market Assessment would be approximately 2.4 mgd (for the month of July).

**Table 10: Recycled Water Supply Assumptions**

| Supply Scenario | Available Recycled Water Supply (mgd) |
|---|---|
| 2006 | 6.2 |
| General Plan Buildout | 2.4 [a] to 8.5 [b] |

Footnotes:

a. During the growing season, a portion of the City's municipal effluent is assumed to be required for dilution of blended biosolids and industrial wastewater effluent for land application in the vicinity of the WSWPCF. West Yost Associates has estimated the maximum monthly requirement to be approximately 188 MG (6.1 mgd) during the month of July. (8.5 mgd – 6.1 mgd = 2.4 mgd)

b. The City is currently in the process of updating its General Plan, and expects that the White Slough WPCF's current permitted capacity of 8.5 mgd will be adequate for the expansions to the City's General Plan boundary (which are expected to result from the current update process).

## 4.2 WID Supply

Approximately 6,000 acre-feet per year (AFY) of Mokelumne River surface water from the Woodbridge Irrigation District (WID) will be available as a potential source for an interim or blended recycled water supply. According to terms of the contract between the City and WID (**Attachment D**), the City may divert surface water from this supply between March 1 and October 15, annually.

California Department of Public Health (CDPH) (formerly the California Department of Health Services) standards for recycled water systems would *not* require additional treatment or water quality monitoring of prior to or following the blending of raw WID water, assuming a) that the raw water is blended with recycled water downstream of the White Slough WPCF, and b) that the blended water in intended for non-potable use.

Additionally, the City has a substantial amount of "banked" WID water, representing the amount of undiverted (paid for) water from years during which this water right was not exercised. Therefore, for approximately the first 10 to 20 years after start up of the City's recycled water distribution system, 6,000 AFY could be treated for potable purposes, while the "banked" water could be used for non-potable uses and will be evaluated for distribution as an annual amount over several years. Based on discussions with City staff, approximately 24,000 AF of WID water is banked as of April 2007. This banked supply may be used to supplement both available recycled water supplies from White Slough WPCF and the normal 6,000 AFY of WID surface water for a certain period of time. At the direction of City staff, a potential strategy for delivering the 24,000 AFY of banked water to users near the main WID canal has been developed. From the pool of potential users identified in Section 2, a subset of users within a distance of 1,000 feet from the main WID canal was identified. The potential demands from the identified subset are presented below.

**Table 11: Potential Demands for Banked WID Supply**

| Potential Users | Average Daily Demand (afy) | Peak Day Demand (mgd) | Peak Hour Demand (gpm) |
|---|---|---|---|
| Potential Users within 1,000 feet of main WID canal [a] | 522 | 1.23 | 1,759 |

Footnote:
a. Does not include potential agricultural users.

Assuming that 24,000 AFY is available for distribution to these users, the demands associated with the identified subset could be met with banked WID water for a period of 46 years. Upon receiving input from the City, RMC will refine this preliminary strategy for inclusion in the *Conceptual Alternatives TM*.

## 4.3 Supply Assessment Summary

The available supplies discussed in Sections 4.1 and 4.2 above are summarized in **Table 12**. The results shown in Table 12 indicate that total annual available WID and recycled water supplies are adequate to meet the total annual potential recycled water demands presented in Table 8.

**Table 12: Summary of Available Supplies and Potential Demands**

| | | Available Supply | |
|---|---|---|---|
| **Available Supplies** | **Supply Source** | **(mgd)** | **(afy)** |
| | White Slough WPCF | 6.2 [a,c] to 8.5 [b,c] | 6,945 [a,c] to 9,521 [b,c] |
| | Annual WID Surface Water Delivery | 5.4 [d] | 6,000 [e] |
| | Banked WID Surface Water Delivery | 0.5 [f] | 522 [g] |
| | **Total** | n/a | **13,467 to 16,043** |
| | | **Average Daily Demand [h]** | |
| **Potential Demands** | **User Category** | **(mgd)** | **(afy)** |
| | Urban | 1.3 | 1,731 |
| | Commercial & Industrial | 2.4 | 1,831 |
| | Agricultural | 8.1 | 9,134 |
| | **Total** | **11.8** | **12,696** |

Footnotes:

a. Based on 2006 effluent data.
b. The City is currently in the process of updating its General Plan, and expects that the White Slough WPCF's current permitted capacity of 8.5 mgd will be adequate for the expansions to the City's General Plan boundaries (which are expected to result from the current update process).
c. During the month of July, approximately 188 MG (6.1 mgd) of municipal wastewater effluent are assumed to be required for dilution of blended biosolids and industrial wastewater effluent for land application in the vicinity of the White Slough WPCF (8.5 mgd – 6.1 mgd = 2.4 mgd). Effluent required for this purpose may be seasonally stored at the White Slough WPCF.
d. Calculated based on annual contract amount (i.e., 6,000 AF/365 days). The actual daily diversion rate may be higher. See also footnote "e."
e. The contract between WID and the City is for a period of 40 years. Refer to Attachment D.
f. Calculated based on assumed annual supply (i.e., 522 AF/365 days). See footnotes "g."
g. Assumes a total banked supply of 24,000 AF, delivered over a period of 46 years (46 x 522 = 24,000). Refer to Section 4.3.
h. Refer to Table 8.

As discussed in Section 3.5, it may not be plausible to serve all of the potential demands identified in this Market Assessment, and certain potential users will necessarily be excluded from a list of users to be served. Following the Large Users Workshops scheduled for June 2007 and the development of the Conceptual Alternatives for this project, the list of users and demands to be served, as well as the supplies to be utilized, will be updated. Additional adjustments to anticipated supplies and demands may also be required as the Master Plan progresses.

# 5 Water Quality Assessment

This section provides a summary of existing and projected recycled water quality, identifies the water quality constituents of potential concern for various potential recycled water users, and evaluates the suitability of recycled water supplies for various potential end-uses.

## 5.1 Lodi White Slough WPCF Effluent Water Quality Data

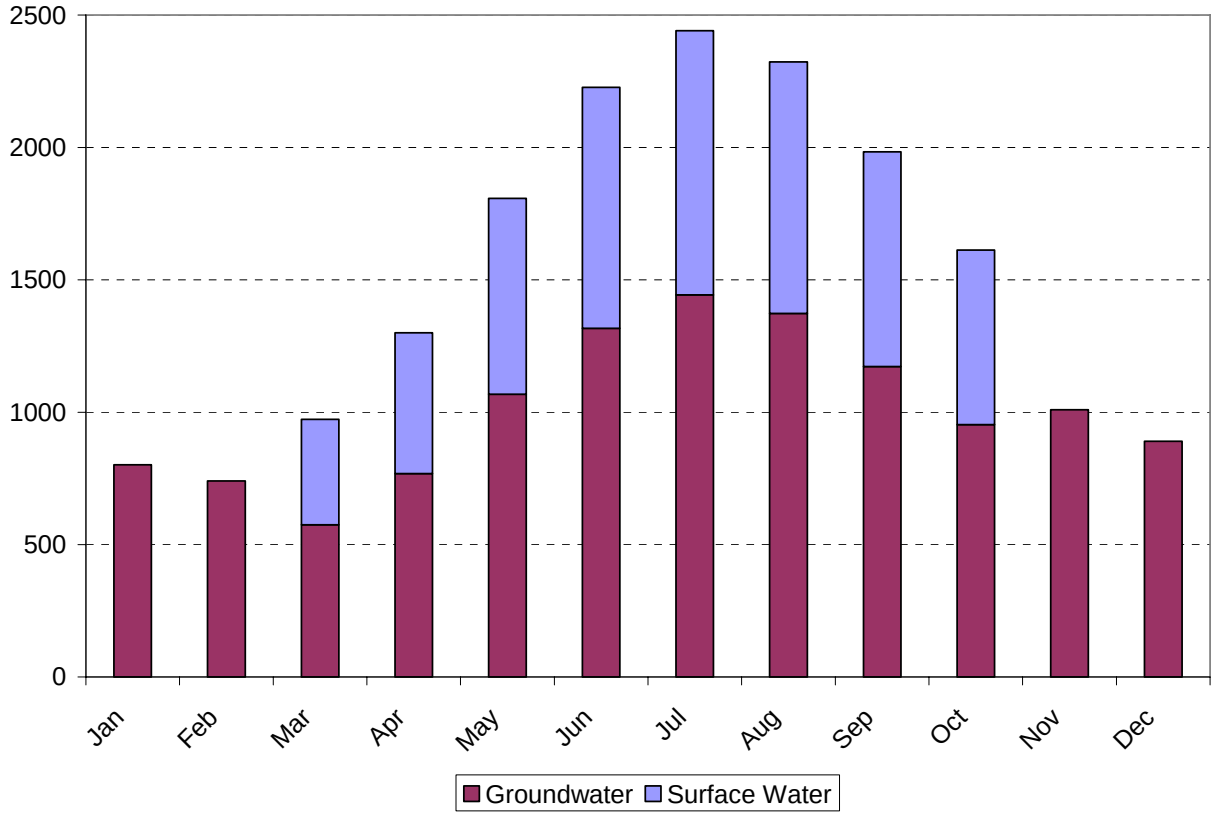
Water quality information for the City's recycled water supplies were collected and analyzed for several constituents of interest throughout 2005 and 2006. The White Slough WPCF effluent water quality for select constituents of interest is summarized in **Table E-1** in **Appendix E**.

Recycled water quality is heavily influenced by drinking water quality. The City of Lodi's current drinking water source is local groundwater.

## 5.2 Local Groundwater/Surface Water Quality

Beginning in 2011, the City plans to incorporate 6,000 AFY of Mokelumne River surface water supplies into its drinking water system, to be delivered between March 1 and October 15 of each year. Based on the City's 2005 Urban Water Management Plan update, annual demands with metering are projected to reach approximately 18,113 AFY in 2011. During the months of March through October, when surface water is incorporated into the system, surface water would be expected to comprise approximately 41 percent of the total supply. **Figure 6** presents anticipated groundwater and surface water supplies in 2011.

**Figure 6: Projected 2011 Monthly Groundwater and Surface Water Deliveries (with Metering)**




The water quality of Mokelumne River surface water differs significantly from local groundwater supplies for many of the constituents of potential concern, as identified in **Table E-2** in Appendix E. Changing the quality of drinking water supplies can be expected to cause a related change in recycled water quality. Water quality monitoring data for local groundwater supplies and Mokelumne River supplies at Woodbridge, CA, near the anticipated diversion location, is presented in Table E-2. In addition, projected blended water quality is presented. It should be noted that the blended water quality presented herein assumes all parameters can be treated as conservative. This assumption should be confirmed through bench-scale water quality testing on blended supplies.

Based on the estimated blended water quality presented in Table E-2, it can be reasonably expected that future recycled water quality will differ from existing recycled water quality for several key constituents of potential concern. **Table E-3** in Appendix E presents projected future recycled water quality, based on estimated changes in drinking water quality resulting from incorporation of surface water supplies. These

estimates were developed by assuming the percent reduction in concentration anticipated to occur in the drinking water supply would also be observed in the recycled water supply. As shown in this table, concentrations of several constituents in recycled water supplies are expected to decrease following introduction of surface water into the drinking water supply.

## 5.3 Water Quality for Specific Recycled Water Uses

Various recycled water quality constituents may be of potential concern, depending upon the end use. Water quality needs for end uses that extend beyond Title 22 regulatory requirements are summarized below.

### 5.3.1 Irrigation Uses

Recycled water may be used for a variety of potential irrigation uses, including golf courses, cemeteries, freeway landscaping, schoolyards, parks, playgrounds, and residential irrigation.

All irrigation waters contain some amount of dissolved mineral salts and chemicals. In general, recycled water has a higher salinity content (reported as total dissolved solids or TDS) than potable water. The rate at which salts accumulate in the soil depends not only on their concentration in the water, but the amount applied, local precipitation rates, and the physical characteristics of the soil.

The suitability of water for irrigation is closely related to the type and concentration of chemical constituents present. Constituents of concern include: salinity, sodium hazard (as determined by the sodium adsorption ratio, SAR), and potential toxicity to plant foliage and roots from other specific constituents. The following paragraphs provide additional detail for these constituents of concern as they relate to use of recycled water for irrigation.

#### Salinity

Grasses which are generally cut short (a stress in itself) are more sensitive to salts than grasses which are not cut short. TDS is a measurement of dissolved solids in the water supply, and is closely related to salinity and electrical conductivity. Good permeability and drainage allow the leaching of excess salts from the root zone when greens are subject to heavy irrigation or flushing.[3]

The City may choose to implement a Salinity Management Plan to monitor salinity impacts to irrigated lands, and to evaluate the effectiveness of the following protective measures:

- **Use of Gypsum.** The use of additional products (such as granulated gypsum) could assist in maintaining concentrations of certain salinity-related constituents at acceptable levels in the root zone. Gypsum has been used successfully in the past to reduce SAR.
- **Modified Irrigation Practices.** It may be necessary to increase watering in order to keep irrigated areas from drying out. When irrigated areas dry out, soluble salts can be drawn back into the root zone at concentrations that could affect plant health.
- **Blending.** Blending recycled water supplies with potable or raw water can help reduce salt buildup.

#### Sodium Adsorption Ratio (SAR)

Soil permeability is reduced when the irrigation water has a high in sodium content.[4] High sodium content can cause the breakdown of soil clay particles, reducing soil aeration and water infiltration and percolation. The likely effect on soil permeability can be evaluated through consideration of the water's SAR in conjunction with the soil electrical conductivity (EC). Additional information about SAR is presented in Appendix E.

[3] WateReuse Meeting, October 15, 2004. Chardonnay Course, Napa.
[4] Harivandi 1999, Interpreting Turfgrass Irrigation Water Test Results.

Based on the City's current WWTP effluent water quality monitoring data, the existing recycled water supply has a SAR value of approximately 2.9. Based on the City's average effluent bicarbonate concentration of 3.1 meq/L, the adjusted SAR may be a more appropriate reference point. The City's current recycled water has an adjusted SAR value of approximately 4.0 (refer to **Table E-1** in Appendix E).

Based on projected changes in drinking water quality resulting from blending new surface water supplies with existing groundwater supplies, and assuming water quality concentrations in recycled water will change in proportion to the changes observed in drinking water, the City's SAR and adjusted SAR values are anticipated to change from current values of 2.9 and 4.0 to approximately 3.1 and 3.9, respectively, following introduction of surface water supplies.

### Other Constituents

The tolerance of plants to various water quality constituents differs by crop/plant type. In addition to salinity and sodium, other constituents of concern include: pH, chloride, boron, chlorine, nutrients (nitrogen, phosphorus, and potassium), and suspended solids. These constituents can have impacts on crops ranging from plant toxicity, which results in leaf burn, to the plugging of sprinkler head openings. Monitoring of irrigated crops during the startup of the recycled water system is recommended.

Researchers have studied crop/plant tolerance to salinity and other constituents and have published water quality guidelines for many agricultural crops and landscape plants. The University of California has compiled this data and developed general guidelines for assessing the suitability of recycled water for irrigation. These guidelines, summarized in conjunction with the City's current and projected water quality data in **Table 13,** are general and flexible and are often modified based on local experience and special conditions of crop, soil, and irrigation method. Recycled water supplies may also retain a trace chlorine residual resulting from the drinking water disinfection process; however, chlorine residuals at concentrations less than 1 mg/L are not expected to be harmful to plants. Some sensitive crop types may be damaged at concentrations as low as 0.05 mg/l, and some woody plants may accumulate chlorine in tissues.

Based on the recycled water quality data collected in 2005 and 2006 and reported in **Table E-1**, the City's recycled water is considered borderline for potential water quality-related problems when used for irrigation.

When the City incorporates surface water into the system, recycled water quality is expected to change. As a result, the City's recycled water is anticipated to generally improve in quality, but would still be considered borderline for potential water quality-related problems when used for irrigation.

Recycled water supplies may also contain trace concentrations of elements which can be harmful to plant life at elevated concentrations. Guidelines for maximum concentrations of trace elements in recycled water used for irrigation are presented in **Table E-4** in Appendix E.

Concentrations of trace constituents monitored in the City's current recycled water supplies currently fall below recommended maximum concentrations It is anticipated that, upon incorporating surface water into the City's drinking water supply, recycled water concentrations for these constituents will remain below the recommended guidelines. Because the City does not currently monitor recycled water supplies for cobalt, lithium, molybdenum, or vanadium, the suitability of recycled water supplies for irrigation cannot be evaluated with respect to these parameters.

**Table 13: Salinity Guidelines[5]**

| Problem and Related Parameters | Units | Water Quality Guidelines | | | City of Lodi Recycled Water Quality Data | |
|---|---|---|---|---|---|---|
| | | No problem | Increasing Problems | Severe Problems | Existing | Future (Estimated) |
| Salinity[a] | | | | | | |
| Electrical Conductivity | mmhos/cm | <0.75 | 0.75 – 3.0 | >3.0 | 0.63 | 0.41 |
| Total Dissolved Solids | mg/L | <480 | 480 – | >1,920 | 377 | 245 |
| Soil Water Infiltration[b] | | | | | | |
| If SAR = 0 to 3 & EC = | | >0.7 | 0.7 – 0.2 | <0.2 | 0.63 | |
| If SAR = 3 to 6 & EC = | | >1.2 | 1.2 – 0.3 | <0.3 | | 0.41 |
| If SAR = 6 to 12 & EC = | | >1.9 | 1.9 – 0.5 | <0.5 | | |
| Permeability | | | | | | |
| Adjusted SAR[c] | | <6.0 | 6.0 – 9.0 | >9.0 | 4 | 3.9 |
| Specific ion toxicity from root absorption[d] | | | | | | |
| Adjusted SAR | | <3.0 | 3.0 – 9.0 | >9.0 | 4 | 3.9 |
| Chloride | mg/L | <142 | 142 – 355 | > 355 | 64 | 41 |
| Boron | mg/L | <0.5 | 0.5 – 2.0 | 2.0 – 10.0 | 0.2 | --[e] |
| Foliar absorption – Sprinklers[f] | | | | | | |
| Sodium | mg/L | <69 | >69 | --- | 73 | 47.4 |
| Chloride | mg/L | <106 | >106 | --- | 73 | 41 |
| Miscellaneous | | | | | | |
| $HCO_3$ (Sprinklers) | mg/l | <90 | 90 – 520 | >520 | 188 | 122 |
| $NH_4$-N and $NO_3$-N | mg/l | <5 | 5 – 30 | >30 | 8 | --[e] |

Footnotes:

a. Assumes water for crop plus needed water for leaching requirement will be applied.
b. Evaluate using EC and SAR together (Harivandi 1999).
c. Permeability problems, related to low EC or high adjusted SAR of water, can be reduced if necessary by adding gypsum. Usual application rate per acre-foot of applied water is from 200 to about 1,000 pounds. 234 pounds of 100% gypsum added to 1 acre-foot of water would supply 1 meq/1 of calcium and raise the EC about 0.1 mmhos.
d. Most tree crops and woody ornamentals are sensitive to sodium and chloride. Most annual crops are not sensitive.
e. Estimated future water quality unknown.
f. Leaf areas wet by sprinklers may show a leaf burn due to sodium or chloride absorption under low humidity/high-evaporation conditions.

## 5.3.2 Industrial Cooling Water

Recycled water can be used as a water supply for water-cooled industrial processes. In a cooling process, a portion of recirculating cooling water is evaporated, to provide cooling. Evaporation of the cooling water causes a loss of pure water to the atmosphere, concentrating dissolved solids in the remaining cooling water supply. In order to keep concentrations below the maximum allowable for a given cooling process, a portion of the concentrated cooling water is discharged (called blowdown or bleed), and the remainder is supplemented with new water (called makeup water) that contains a lower concentration of dissolved solids, providing some level of dilution. The constituent concentration in the cooling water is governed by the makeup water quality and feed rate as well as the blowdown or bleed rate. Higher quality makeup water containing lower concentrations of constituents will allow an increased number of

[5] Harivandi, A. Interpreting Turfgrass Irrigation Water Test Results; UC Davis Division of Agriculture and Natural Resources (UC ANR), Publication 8009; 1999.

cooling cycles before reaching the maximum allowable constituent concentration. Constituents of interest for recycled water used in industrial cooling processes are summarized in **Table E-5** in Appendix E.

Concentration of dissolved solids over time can cause scale buildup, blockages, and corrosion to cooling system materials unless carefully managed. Specific issues associated with water quality constituents of concern are highly dependent on the cooling tower construction materials. The effect of water quality constituents of concern on various types of construction materials are presented in **Table E-6** in Appendix E.

Based on the maximum recommended concentrations for the parameters identified in **Table E-5**, the City's current recycled water supply is suitable for use in industrial cooling applications. Alkalinity and phosphate concentrations may be somewhat high for this application; however, implementation of targeted treatment processes can minimize potential impacts of these constituents. Application-specific treatment approaches should be developed to optimize recycled water quality for process cooling as appropriate.

The integration of surface water into the drinking water supply will not alter the suitability of the recycled water quality for this purpose.

### 5.3.3 Boiler Feed Water

The pressure and design of a boiler are the criteria used to determine the necessary water quality of steam generation to avoid deposits, corrosion, and carryover of contaminants into the steam. Boiler feedwater includes condensate from generated steam and treated makeup water used to reduce the presence of contaminants and dilute contaminants present in boiler condensate. Generally, boiler feedwater is treated to reduce hardness, to remove or control insoluble scales of calcium and magnesium, and to control silica and aluminum concentrations. These constituents are the principal cause of scale buildup in boilers. A common approach to removing these constituents is lime treatment (including flocculation, sedimentation, and recarbonation) followed by multi-media filtration, carbon adsorption, and nitrogen removal. Higher pressure processes generally require higher quality feedwater; some high-pressure boilers may require reverse osmosis or ion exchange treatment.[6]

The guidelines for recommended maximum concentrations for boiler feedwater quality are presented in **Table E-7** in Appendix E.

The City's current groundwater supply and the projected blended groundwater and surface water supply would both require treatment prior to use as boiler feedwater. Similarly, the City's current and projected future recycled water would require additional treatment prior to use as boiler feedwater.

### 5.3.4 Industrial Process Water

Water quality requirements for use in industrial processes vary depending upon the process. The semiconductor industry requires exceptionally high quality water; conversely, the tanning industry can use relatively low quality water. **Table E-8** in Appendix E presents water quality requirements for a variety of industrial processes.

Based on current recycled water quality monitoring information, existing and future recycled water would require treatment for use in the pulp and paper, chemical, petrochemical, textile, coal, and cement industries. Additional monitoring would be required prior to implementation.

[6] Santa Clara Valley Water District. Advanced Recycled Water Treatment Feasibility Project, TM 2: Market Assessment, Table 9. August, 2003.

## 5.4 Recycled Water Quality Monitoring

Water quality data for several constituents of particular interest in the City's existing recycled water supply was not available at the time of this study and additional specific end uses could not be determined. A recycled water quality monitoring program should be implemented as part of the power plant connection in the future to provide adequate information to allow the City to make reasonable determinations as to the suitability of the supply – or necessary treatment – to support other proposed end uses.

## 5.5 Water Quality Summary

The City's current and future recycled water supply is generally of good quality for a variety of uses. Although the current sodium concentration of 73 mg/L is near the upper end of a desirable range of sodium concentrations, the future recycled water is anticipated to have a sodium concentration of approximately 47 mg/L, well below the maximum desirable concentration.

The City's current and future recycled water supply is suitable for use in industrial cooling applications, although alkalinity and phosphate concentrations may be somewhat high. Targeted treatment processes can alleviate potential impacts from these constituents. The City's current groundwater supply, projected blended groundwater and surface water supply, and current and projected recycled water would all require additional treatment prior to use as boiler feedwater. Water quality requirements for other industrial processes vary greatly depending upon the process. Current and future recycled water supplies would require additional treatment prior to use in the pulp and paper, chemical, petrochemical, textile, coal, and cement industries.

Recycled water typically has higher salinity content than potable water, although several protective measures can be used to reduce negative impacts. Additionally, the City may choose to implement a salinity management program to monitor salinity impacts to irrigated lands and evaluate the effectiveness of the protective measures. Current recycled water constituent concentrations are below recommended values for trace elements currently being monitored. When the City blends surface water into existing groundwater supplies, the improved drinking water quality is expected improve overall recycled water quality as well.

A recycled water quality monitoring program should be implemented to allow the City to make reasonable determinations as to the suitability of the supply or necessary treatment to support other proposed end uses.

# 6 Conclusions & Next Steps

Based on the information presented in this TM, there appears to be adequate justification for further development of a RWMP for the City. During the subsequent phase of this project, Conceptual Alternatives will be developed for the delivery of recycled water in Lodi. As part of the Conceptual Alternative development process, the list of potential users will be modified as necessary to achieve the optimal balance between maximized beneficial use of recycled water, technical feasibility, operational flexibility, (phased) constructability, and capital expenditures.

# Attachment B: Detailed List of Potential Recycled Water Users

Attachment B

Table B-1

| | | | | | | Water Meter Information | Irrigation Demand | | | | | | | | WUF-Based Irrigation and Non-Irrigation Demand | | | | | | | | | Total Demand | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Area | Potential User ID | Acres | Category | Name | Existing? | Water Meter Data? | Metered Average Day Demand | Irrigable Area | Unit Irrigation Demand | Irrigation Demand | Average Day Demand | Peak Day Demand | Peak Hour Demand | | WUF | Unadjusted Average Day Demand | $K_{WUF}$ | Adjust Average Day Demand | Additional Demand | Total Average Day Demand | Annual Demand | Peak Day Demand | Peak Hour Demand | | Total Peak Hour Demand | | Total Peak Day Demand | Total Average Annual Demand | |
| (sq. ft.) | | | | | (Y/N) | (Y/N) | (gpd) | (acres) | (AFY/acre) | (AFY) | (gpd) | (gpd) | (gpm) | (mgd) | (gpd/acre) | (gpd) | (%) | (gpd) | (gpd) | (gpd) | (afy) | (gpd) | (gpm) | (mgd) | (gpm) | (mgd) | (mgd) | (mgd) | (afy) |
| 47,400.7684 | 62 | 1.0882 | Agricultural | Miscellaneous Field Crop | Y | N | - | 1.08 | 1.89 | 2.0 | 1,813 | 8,439 | 12 | 0.02 | - | - | 0% | - | | - | - | - | - | - | 12 | 0.02 | 0.01 | 0.00 | 2.0 |
| 91,944.8323 | 61 | 2.1108 | Agricultural | Miscellaneous Field Crop | Y | N | - | 2.09 | 1.89 | 3.9 | 3,517 | 16,370 | 23 | 0.03 | - | - | 0% | - | | - | - | - | - | - | 23 | 0.03 | 0.02 | 0.00 | 3.9 |
| 92,095.5000 | 154 | 2.1142 | Agricultural | Miscellaneous Field Crop | Y | N | - | 2.09 | 1.89 | 3.9 | 3,523 | 16,397 | 23 | 0.03 | - | - | 0% | - | | - | - | - | - | - | 23 | 0.03 | 0.02 | 0.00 | 3.9 |
| 92,599.7254 | 63 | 2.1258 | Agricultural | Miscellaneous Field Crop | Y | N | - | 2.10 | 1.89 | 4.0 | 3,542 | 16,487 | 23 | 0.03 | - | - | 0% | - | | - | - | - | - | - | 23 | 0.03 | 0.02 | 0.00 | 4.0 |
| 110,884.9380 | 205 | 2.5456 | Agricultural | Miscellaneous Field Crop | Y | N | - | 2.52 | 1.89 | 4.8 | 4,242 | 19,742 | 27 | 0.04 | - | - | 0% | - | | - | - | - | - | - | 27 | 0.04 | 0.02 | 0.00 | 4.8 |
| 132,539.1870 | 142 | 3.0427 | Agricultural | Vineyard | Y | N | - | 3.01 | 2.23 | 6.7 | 5,993 | 18,513 | 26 | 0.04 | - | - | 0% | - | | - | - | - | - | - | 26 | 0.04 | 0.02 | 0.01 | 6.7 |
| 159,475.2500 | 193 | 3.6610 | Agricultural | Miscellaneous Field Crop | Y | N | - | 3.62 | 1.89 | 6.8 | 6,101 | 28,394 | 39 | 0.06 | - | - | 0% | - | | - | - | - | - | - | 39 | 0.06 | 0.03 | 0.01 | 6.8 |
| 161,687.3120 | 124 | 3.7118 | Agricultural | Vineyard | Y | N | - | 3.67 | 2.23 | 8.2 | 7,311 | 22,585 | 31 | 0.05 | - | - | 0% | - | | - | - | - | - | - | 31 | 0.05 | 0.02 | 0.01 | 8.2 |
| 170,292.3370 | 218 | 3.9094 | Agricultural | Vineyard | Y | N | - | 3.87 | 2.23 | 8.6 | 7,700 | 23,787 | 33 | 0.05 | - | - | 0% | - | | - | - | - | - | - | 33 | 0.05 | 0.02 | 0.01 | 8.6 |
| 172,192.1780 | 149 | 3.9530 | Agricultural | Orchard | Y | N | - | 3.91 | 3.06 | 12.0 | 10,678 | 29,010 | 40 | 0.06 | - | - | 0% | - | | - | - | - | - | - | 40 | 0.06 | 0.03 | 0.01 | 12.0 |
| 173,373.5930 | 77 | 3.9801 | Agricultural | Miscellaneous Field Crop | Y | N | - | 3.94 | 1.89 | 7.4 | 6,633 | 30,868 | 43 | 0.06 | - | - | 0% | - | | - | - | - | - | - | 43 | 0.06 | 0.03 | 0.01 | 7.4 |
| 178,818.1860 | 217 | 4.1051 | Agricultural | Orchard | Y | N | - | 4.06 | 3.06 | 12.4 | 11,088 | 30,126 | 42 | 0.06 | - | - | 0% | - | | - | - | - | - | - | 42 | 0.06 | 0.03 | 0.01 | 12.4 |
| 178,929.5520 | 219 | 4.1077 | Agricultural | Orchard | Y | N | - | 4.07 | 3.06 | 12.4 | 11,095 | 30,145 | 42 | 0.06 | - | - | 0% | - | | - | - | - | - | - | 42 | 0.06 | 0.03 | 0.01 | 12.4 |
| 182,281.7500 | 133 | 4.1846 | Agricultural | Orchard | Y | N | - | 4.14 | 3.06 | 12.7 | 11,303 | 30,710 | 43 | 0.06 | - | - | 0% | - | | - | - | - | - | - | 43 | 0.06 | 0.03 | 0.01 | 12.7 |
| 185,464.3750 | 190 | 4.2577 | Agricultural | Miscellaneous Field Crop | Y | N | - | 4.22 | 1.89 | 7.9 | 7,095 | 33,021 | 46 | 0.07 | - | - | 0% | - | | - | - | - | - | - | 46 | 0.07 | 0.03 | 0.01 | 7.9 |
| 189,988.0230 | 87 | 4.3615 | Agricultural | Vineyard | Y | N | - | 4.32 | 2.23 | 9.6 | 8,590 | 26,538 | 37 | 0.05 | - | - | 0% | - | | - | - | - | - | - | 37 | 0.05 | 0.03 | 0.01 | 9.6 |
| 193,268.9150 | 88 | 4.4368 | Agricultural | Vineyard | Y | N | - | 4.39 | 2.23 | 9.8 | 8,739 | 26,996 | 37 | 0.05 | - | - | 0% | - | | - | - | - | - | - | 37 | 0.05 | 0.03 | 0.01 | 9.8 |
| 206,468.5620 | 161 | 4.7399 | Agricultural | Miscellaneous Field Crop | Y | N | - | 4.69 | 1.89 | 8.8 | 7,899 | 36,760 | 51 | 0.07 | - | - | 0% | - | | - | - | - | - | - | 51 | 0.07 | 0.04 | 0.01 | 8.8 |
| 221,222.5000 | 197 | 5.0786 | Agricultural | Vineyard | Y | N | - | 5.03 | 2.23 | 11.2 | 10,003 | 30,901 | 43 | 0.06 | - | - | 0% | - | | - | - | - | - | - | 43 | 0.06 | 0.03 | 0.01 | 11.2 |
| 222,637.6250 | 191 | 5.1111 | Agricultural | Miscellaneous Field Crop | Y | N | - | 5.06 | 1.89 | 9.5 | 8,517 | 39,639 | 55 | 0.08 | - | - | 0% | - | | - | - | - | - | - | 55 | 0.08 | 0.04 | 0.01 | 9.5 |
| 223,119.3130 | 198 | 5.1221 | Agricultural | Vineyard | Y | N | - | 5.07 | 2.23 | 11.3 | 10,088 | 31,166 | 43 | 0.06 | - | - | 0% | - | | - | - | - | - | - | 43 | 0.06 | 0.03 | 0.01 | 11.3 |
| 233,325.2410 | 215 | 5.3564 | Agricultural | Vineyard | Y | N | - | 5.30 | 2.23 | 11.8 | 10,550 | 32,591 | 45 | 0.07 | - | - | 0% | - | | - | - | - | - | - | 45 | 0.07 | 0.03 | 0.01 | 11.8 |
| 252,249.0000 | 196 | 5.7908 | Agricultural | Vineyard | Y | N | - | 5.73 | 2.23 | 12.8 | 11,406 | 35,235 | 49 | 0.07 | - | - | 0% | - | | - | - | - | - | - | 49 | 0.07 | 0.04 | 0.01 | 12.8 |
| 258,784.5630 | 164 | 5.9409 | Agricultural | Miscellaneous Field Crop | Y | N | - | 5.88 | 1.89 | 11.1 | 9,900 | 46,075 | 64 | 0.09 | - | - | 0% | - | | - | - | - | - | - | 64 | 0.09 | 0.05 | 0.01 | 11.1 |
| 278,455.3750 | 92 | 6.3925 | Agricultural | Vineyard | Y | N | - | 6.33 | 2.23 | 14.1 | 12,590 | 38,895 | 54 | 0.08 | - | - | 0% | - | | - | - | - | - | - | 54 | 0.08 | 0.04 | 0.01 | 14.1 |
| 295,445.1880 | 98 | 6.7825 | Agricultural | Miscellaneous Field Crop | Y | N | - | 6.71 | 1.89 | 12.7 | 11,302 | 52,602 | 73 | 0.11 | - | - | 0% | - | | - | - | - | - | - | 73 | 0.11 | 0.05 | 0.01 | 12.7 |
| 296,267.5000 | 169 | 6.8014 | Agricultural | Miscellaneous Field Crop | Y | N | - | 6.73 | 1.89 | 12.7 | 11,334 | 52,749 | 73 | 0.11 | - | - | 0% | - | | - | - | - | - | - | 73 | 0.11 | 0.05 | 0.01 | 12.7 |
| 308,835.2020 | 81 | 7.0899 | Agricultural | Vineyard | Y | N | - | 7.02 | 2.23 | 15.6 | 13,964 | 43,139 | 60 | 0.09 | - | - | 0% | - | | - | - | - | - | - | 60 | 0.09 | 0.04 | 0.01 | 15.6 |
| 310,665.0630 | 214 | 7.1319 | Agricultural | Miscellaneous Field Crop | Y | N | - | 7.06 | 1.89 | 13.3 | 11,885 | 55,312 | 77 | 0.11 | - | - | 0% | - | | - | - | - | - | - | 77 | 0.11 | 0.06 | 0.01 | 13.3 |
| 321,625.1870 | 207 | 7.3835 | Agricultural | Orchard | Y | N | - | 7.31 | 3.06 | 22.3 | 19,944 | 54,186 | 75 | 0.11 | - | - | 0% | - | | - | - | - | - | - | 75 | 0.11 | 0.05 | 0.02 | 22.3 |
| 327,393.1870 | 85 | 7.5159 | Agricultural | Miscellaneous Field Crop | Y | N | - | 7.44 | 1.89 | 14.0 | 12,525 | 58,290 | 81 | 0.12 | - | - | 0% | - | | - | - | - | - | - | 81 | 0.12 | 0.06 | 0.01 | 14.0 |
| 328,498.0000 | 84 | 7.5413 | Agricultural | Miscellaneous Field Crop | Y | N | - | 7.47 | 1.89 | 14.1 | 12,567 | 58,487 | 81 | 0.12 | - | - | 0% | - | | - | - | - | - | - | 81 | 0.12 | 0.06 | 0.01 | 14.1 |
| 335,017.5000 | 116 | 7.6909 | Agricultural | Miscellaneous Field Crop | Y | N | - | 7.61 | 1.89 | 14.4 | 12,816 | 59,648 | 83 | 0.12 | - | - | 0% | - | | - | - | - | - | - | 83 | 0.12 | 0.06 | 0.01 | 14.4 |
| 345,438.8120 | 180 | 7.9302 | Agricultural | Vineyard | Y | N | - | 7.85 | 2.23 | 17.5 | 15,619 | 48,251 | 67 | 0.10 | - | - | 0% | - | | - | - | - | - | - | 67 | 0.10 | 0.05 | 0.02 | 17.5 |
| 345,672.2600 | 135 | 7.9355 | Agricultural | Vineyard | Y | N | - | 7.86 | 2.23 | 17.5 | 15,630 | 48,284 | 67 | 0.10 | - | - | 0% | - | | - | - | - | - | - | 67 | 0.10 | 0.05 | 0.02 | 17.5 |
| 366,833.8740 | 86 | 8.4213 | Agricultural | Vineyard | Y | N | - | 8.34 | 2.23 | 18.6 | 16,587 | 51,240 | 71 | 0.10 | - | - | 0% | - | | - | - | - | - | - | 71 | 0.10 | 0.05 | 0.02 | 18.6 |
| 381,457.0870 | 178 | 8.7570 | Agricultural | Miscellaneous Field Crop | Y | N | - | 8.67 | 1.89 | 16.3 | 14,593 | 67,916 | 94 | 0.14 | - | - | 0% | - | | - | - | - | - | - | 94 | 0.14 | 0.07 | 0.01 | 16.3 |
| 394,032.5000 | 153 | 9.0457 | Agricultural | Miscellaneous Field Crop | Y | N | - | 8.96 | 1.89 | 16.9 | 15,074 | 70,155 | 97 | 0.14 | - | - | 0% | - | | - | - | - | - | - | 97 | 0.14 | 0.07 | 0.02 | 16.9 |
| 409,894.8130 | 106 | 9.4099 | Agricultural | Miscellaneous Field Crop | Y | N | - | 9.32 | 1.89 | 17.6 | 15,681 | 72,979 | 101 | 0.15 | - | - | 0% | - | | - | - | - | - | - | 101 | 0.15 | 0.07 | 0.02 | 17.6 |
| 420,480.5820 | 59 | 9.6529 | Agricultural | Vineyard | Y | N | - | 9.56 | 2.23 | 21.3 | 19,012 | 58,733 | 82 | 0.12 | - | - | 0% | - | | - | - | - | - | - | 82 | 0.12 | 0.06 | 0.02 | 21.3 |
| 421,413.4400 | 60 | 9.6743 | Agricultural | Miscellaneous Field Crop | Y | N | - | 9.58 | 1.89 | 18.1 | 16,122 | 75,030 | 104 | 0.15 | - | - | 0% | - | | - | - | - | - | - | 104 | 0.15 | 0.08 | 0.02 | 18.1 |
| 421,740.0000 | 64 | 9.6818 | Agricultural | Miscellaneous Field Crop | Y | N | - | 9.59 | 1.89 | 18.1 | 16,134 | 75,088 | 104 | 0.15 | - | - | 0% | - | | - | - | - | - | - | 104 | 0.15 | 0.08 | 0.02 | 18.1 |
| 422,378.1880 | 182 | 9.6965 | Agricultural | Vineyard | Y | N | - | 9.60 | 2.23 | 21.4 | 19,098 | 58,998 | 82 | 0.12 | - | - | 0% | - | | - | - | - | - | - | 82 | 0.12 | 0.06 | 0.02 | 21.4 |
| 426,124.1740 | 76 | 9.7825 | Agricultural | Miscellaneous Field Crop | Y | N | - | 9.68 | 1.89 | 18.3 | 16,302 | 75,869 | 105 | 0.15 | - | - | 0% | - | | - | - | - | - | - | 105 | 0.15 | 0.08 | 0.02 | 18.3 |
| 428,100.0000 | 68 | 9.8278 | Agricultural | Orchard | Y | N | - | 9.73 | 3.06 | 29.7 | 26,546 | 72,124 | 100 | 0.14 | - | - | 0% | - | | - | - | - | - | - | 100 | 0.14 | 0.07 | 0.03 | 29.7 |
| 430,156.8750 | 171 | 9.8750 | Agricultural | Vineyard | Y | N | - | 9.78 | 2.23 | 21.8 | 19,450 | 60,085 | 83 | 0.12 | - | - | 0% | - | | - | - | - | - | - | 83 | 0.12 | 0.06 | 0.02 | 21.8 |
| 432,955.8750 | 185 | 9.9393 | Agricultural | Miscellaneous Field Crop | Y | N | - | 9.84 | 1.89 | 18.6 | 16,563 | 77,085 | 107 | 0.15 | - | - | 0% | - | | - | - | - | - | - | 107 | 0.15 | 0.08 | 0.02 | 18.6 |
| 434,191.5630 | 94 | 9.9677 | Agricultural | Vineyard | Y | N | - | 9.87 | 2.23 | 22.0 | 19,632 | 60,649 | 84 | 0.12 | - | - | 0% | - | | - | - | - | - | - | 84 | 0.12 | 0.06 | 0.02 | 22.0 |
| 434,304.6880 | 100 | 9.9703 | Agricultural | Miscellaneous Field Crop | Y | N | - | 9.87 | 1.89 | 18.6 | 16,615 | 77,325 | 107 | 0.15 | - | - | 0% | - | | - | - | - | - | - | 107 | 0.15 | 0.08 | 0.02 | 18.6 |
| 435,581.7220 | 65 | 9.9996 | Agricultural | Miscellaneous Field Crop | Y | N | - | 9.90 | 1.89 | 18.7 | 16,664 | 77,553 | 108 | 0.16 | - | - | 0% | - | | - | - | - | - | - | 108 | 0.16 | 0.08 | 0.02 | 18.7 |
| 437,539.3460 | 58 | 10.0445 | Agricultural | Orchard | Y | N | - | 9.94 | 3.06 | 30.4 | 27,132 | 73,714 | 102 | 0.15 | - | - | 0% | - | | - | - | - | - | - | 102 | 0.15 | 0.07 | 0.03 | 30.4 |
| 438,900.6250 | 95 | 10.0758 | Agricultural | Vineyard | Y | N | - | 9.98 | 2.23 | 22.2 | 19,845 | 61,306 | 85 | 0.12 | - | - | 0% | - | | - | - | - | - | - | 85 | 0.12 | 0.06 | 0.02 | 22.2 |
| 440,748.1870 | 173 | 10.1182 | Agricultural | Miscellaneous Field Crop | Y | N | - | 10.02 | 1.89 | 18.9 | 16,861 | 78,472 | 109 | 0.16 | - | - | 0% | - | | - | - | - | - | - | 109 | 0.16 | 0.08 | 0.02 | 18.9 |
| 442,193.2960 | 75 | 10.1514 | Agricultural | Orchard | Y | N | - | 10.05 | 3.06 | 30.7 | 27,420 | 74,498 | 103 | 0.15 | - | - | 0% | - | | - | - | - | - | - | 103 | 0.15 | 0.07 | 0.03 | 30.7 |
| 444,006.3750 | 186 | 10.1930 | Agricultural | Miscellaneous Field Crop | Y | N | - | 10.09 | 1.89 | 19.0 | 16,986 | 79,053 | 110 | 0.16 | - | - | 0% | - | | - | - | - | - | - | 110 | 0.16 | 0.08 | 0.02 | 19.0 |
| 452,510.6810 | 201 | 10.3882 | Agricultural | Orchard | Y | N | - | 10.28 | 3.06 | 31.4 | 28,060 | 76,236 | 106 | 0.15 | - | - | 0% | - | | - | - | - | - | - | 106 | 0.15 | 0.08 | 0.03 | 31.4 |
| 464,321.8130 | 192 | 10.6594 | Agricultural | Miscellaneous Field Crop | Y | N | - | 10.55 | 1.89 | 19.9 | 17,763 | 82,670 | 115 | 0.17 | - | - | 0% | - | | - | - | - | - | - | 115 | 0.17 | 0.08 | 0.02 | 19.9 |
| 515,743.1870 | 179 | 11.8398 | Agricultural | Vineyard | Y | N | - | 11.72 | 2.23 | 26.1 | 23,320 | 72,040 | 100 | 0.14 | - | - | 0% | - | | - | - | - | - | - | 100 | 0.14 | 0.07 | 0.02 | 26.1 |
| 546,921.5620 | 170 | 12.5556 | Agricultural | Miscellaneous Field Crop | Y | N | - | 12.43 | 1.89 | 23.4 | 20,923 | 97,376 | 135 | 0.19 | - | - | 0% | - | | - | - | - | - | - | 135 | 0.19 | 0.10 | 0.02 | 23.4 |
| 593,853.6130 | 82 | 13.6330 | Agricultural | Vineyard | Y | N | - | 13.50 | 2.23 | 30.1 | 26,851 | 82,950 | 115 | 0.17 | - | - | 0% | - | | - | - | - | - | - | 115 | 0.17 | 0.08 | 0.03 | 30.1 |
| 596,836.4380 | 125 | 13.7015 | Agricultural | Vineyard | Y | N | - | 13.56 | 2.23 | 30.2 | 26,986 | 83,367 | 116 | 0.17 | - | - | 0% | - | | - | - | - | - | - | 116 | 0.17 | 0.08 | 0.03 | 30.2 |
| 597,665.6520 | 148 | 13.7205 | Agricultural | Vineyard | Y | N | - | 13.58 | 2.23 | 30.3 | 27,024 | 83,483 | 116 | 0.17 | - | - | 0% | - | | - | - | - | - | - | 116 | 0.17 | 0.08 | 0.03 | 30.3 |
| 599,415.1280 | 216 | 13.7607 | Agricultural | Miscellaneous Field Crop | Y | N | - | 13.62 | 1.89 | 25.7 | 22,931 | 106,722 | 148 | 0.21 | - | - | 0% | - | | - | - | - | - | - | 148 | 0.21 | 0.11 | 0.02 | 25.7 |
| 613,279.1250 | 194 | 14.0790 | Agricultural | Vineyard | Y | N | - | 13.94 | 2.23 | 31.1 | 27,730 | 85,664 | 119 | 0.17 | - | - | 0% | - | | - | - | - | - | - | 119 | 0.17 | 0.09 | 0.03 | 31.1 |
| 617,683.1950 | 80 | 14.1801 | Agricultural | Vineyard | Y | N | - | 14.04 | 2.23 | 31.3 | 27,929 | 86,279 | 120 | 0.17 | - | - | 0% | - | | - | - | - | - | - | 120 | 0.17 | 0.09 | 0.03 | 31.3 |
| 633,431.2150 | 183 | 14.5416 | Agricultural | Miscellaneous Field Crop | Y | N | - | 14.40 | 1.89 | 27.1 | 24,232 | 112,778 | 157 | 0.23 | - | - | 0% | - | | - | - | - | - | - | 157 | 0.23 | 0.11 | 0.02 | 27.1 |
| 638,295.1250 | 195 | 14.6532 | Agricultural | Miscellaneous Field Crop | Y | N | - | 14.51 | 1.89 | 27.4 | 24,418 | 113,644 | 158 | 0.23 | - | - | 0% | - | | - | - | - | - | - | 158 | 0.23 | 0.11 | 0.02 | 27.4 |
| 645,259.9370 | 113 | 14.8131 | Agricultural | Miscellaneous Field Crop | Y | N | - | 14.66 | 1.89 | 27.7 | 24,685 | 114,885 | 160 | 0.23 | - | - | 0% | - | | - | - | - | - | - | 160 | 0.23 | 0.11 | 0.02 | 27.7 |
| 645,638.5000 | 174 | 14.8218 | Agricultural | Vineyard | Y | N | - | 14.67 | 2.23 | 32.7 | 29,193 | 90,184 | 125 | 0.18 | - | - | 0% | - | | - | - | - | - | - | 125 | 0.18 | 0.09 | 0.03 | 32.7 |
| 655,300.3130 | 103 | 15.0436 | Agricultural | Orchard | Y | N | - | 14.89 | 3.06 | 45.5 | 40,635 | 110,401 | 153 | 0.22 | - | - | 0% | - | | - | - | - | - | - | 153 | 0.22 | 0.11 | 0.04 | 45.5 |
| 658,721.0290 | 146 | 15.1222 | Agricultural | Orchard | Y | N | - | 14.97 | 3.06 | 45.8 | 40,847 | 110,978 | 154 | 0.22 | - | - | 0% | - | | - | - | - | - | - | 154 | 0.22 | 0.11 | 0.04 | 45.8 |
| 688,286.5000 | 208 | 15.8009 | Agricultural | Orchard | Y | N | - | 15.64 | 3.06 | 47.8 | 42,680 | 115,959 | 161 | 0.23 | - | - | 0% | - | | - | - | - | - | - | 161 | 0.23 | 0.12 | 0.04 | 47.8 |
| 713,612.0630 | 99 | 16.3823 | Agricultural | Vineyard | Y | N | - | 16.22 | 2.23 | 36.1 | 32,266 | 99,679 | 138 | 0.20 | - | - | 0% | - | | - | - | - | - | - | 138 | 0.20 | 0.10 | 0.03 | 36.1 |
| 717,670.0630 | 168 | 16.4754 | Agricultural | Miscellaneous Field Crop | Y | N | - | 16.31 | 1.89 | 30.8 | 27,455 | 127,777 | 177 | 0.26 | - | - | 0% | - | | - | - | - | - | - | 177 | 0.26 | 0.13 | 0.03 | 30.8 |
| 718,511.3410 | 79 | 16.4948 | Agricultural | Vineyard | Y | N | - | 16.33 | 2.23 | 36.4 | 32,488 | 100,363 | 139 | 0.20 | - | - | 0% | - | | - | - | - | - | - | 139 | 0.20 | 0.10 | 0.03 | 36.4 |
| 751,258.9990 | 78 | 17.2465 | Agricultural | Orchard | Y | N | - | 17.07 | 3.06 | 52.2 | 46,585 | 126,568 | 176 | 0.25 | - | - | 0% | - | | - | - | - | - | - | 176 | 0.25 | 0.13 | 0.05 | 52.2 |
| 753,405.3750 | 162 | 17.2958 | Agricultural | Miscellaneous Field Crop | Y | N | - | 17.12 | 1.89 | 32.3 | 28,822 | 134,139 | 186 | 0.27 | - | - | 0% | - | | - | - | - | - | - | 186 | 0.27 | 0.13 | 0.03 | 32.3 |
| 754,328.9380 | 152 | 17.3170 | Agricultural | Miscellaneous Field Crop | Y | N | - | 17.14 | 1.89 | 32.3 | 28,857 | 134,304 | 187 | 0.27 | - | - | 0% | - | | - | - | - | - | - | 187 | 0.27 | 0.13 | 0.03 | 32.3 |
| 761,591.8750 | 213 | 17.4837 | Agricultural | Miscellaneous Field Crop | Y | N | - | 17.31 | 1.89 | 32.6 | 29,135 | 135,597 | 188 | 0.27 | - | - | 0% | - | | - | - | - | - | - | 188 | 0.27 | 0.14 | 0.03 | 32.6 |
| 765,402.0000 | 211 | 17.5712 | Agricultural | Miscellaneous Field Crop | Y | N | - | 17.40 | 1.89 | 32.8 | 29,281 | 136,275 | 189 | 0.27 | - | - | 0% | - | | - | - | - | - | - | 189 | 0.27 | 0.14 | 0.03 | 32.8 |
| 777,895.1250 | 206 | 17.8580 | Agricultural | Miscellaneous Field Crop | Y | N | - | 17.68 | 1.89 | 33.3 | 29,759 | 138,499 | 192 | 0.28 | - | - | 0% | - | | - | - | - | - | - | 192 | 0.28 | 0.14 | 0.03 | 33.3 |
| 778,923.3390 | 83 | 17.8816 | Agricultural | Vineyard | Y | N | - | 17.70 | 2.23 | 39.5 | 35,219 | 108,801 | 151 | 0.22 | - | - | 0% | - | | - | - | - | - | - | 151 | 0.22 | 0.11 | 0.04 | 39.5 |
| 787,690.6870 | 175 | 18.0829 | Agricultural | Vineyard | Y | N | - | 17.90 | 2.23 | 39.9 | 35,616 | 110,026 | 153 | 0.22 | - | - | 0% | - | | - | - | - | - | - | 153 | 0.22 | 0.11 | 0.04 | 39.9 |
| 815,750.4730 | 74 | 18.7271 | Agricultural | Vineyard | Y | N | - | 18.54 | 2.23 | 41.3 | 36,885 | 113,945 | 158 | 0.23 | - | - | 0% | - | | - | - | - | - | - | 158 | 0.23 | 0.11 | 0.04 | 41.3 |
| 820,057.0000 | 203 | 18.8259 | Agricultural | Miscellaneous Field Crop | Y | N | - | 18.64 | 1.89 | 35.1 | 31,372 | 146,006 | 203 | 0.29 | - | - | 0% | - | | - | - | - | - | - | 203 | 0.29 | 0.15 | 0.03 | 35.1 |
| 836,257.9380 | 188 | 19.1978 | Agricultural | Vineyard | Y | N | - | 19.01 | 2.23 | 42.4 | 37,812 | 116,810 | 162 | 0.23 | - | - | 0% | - | | - | - | - | - | - | 162 | 0.23 | 0.12 | 0.04 | 42.4 |
| 852,281.1470 | 177 | 19.5657 | Agricultural | Vineyard | Y | N | - | 19.37 | 2.23 | 43.2 | 38,536 | 119,048 | 165 | 0.24 | - | - | 0% | - | | - | - | - | - | - | 165 | 0.24 | 0.12 | 0.04 | 43.2 |
| 854,191.0000 | 70 | 19.6095 | Agricultural | Orchard | Y | N | - | 19.41 | 3.06 | 59.3 | 52,968 | 143,909 | 200 | 0.29 | - | - | 0% | - | | - | - | - | - | - | 200 | 0.29 | 0.14 | 0.05 | 59.3 |
| 854,551.6480 | 69 | 19.6178 | Agricultural | Orchard | Y | N | - | 19.42 | 3.06 | 59.4 | 52,990 | 143,970 | 200 | 0.29 | - | - | 0% | - | | - | - | - | - | - | 200 | 0.29 | 0.14 | 0.05 | 59.4 |
| 857,404.8790 | 57 | 19.6833 | Agricultural | Orchard | Y | N | - | 19.49 | 3.06 | 59.6 | 53,167 | 144,451 | 201 | 0.29 | - | - | 0% | - | | - | - | - | - | - | 201 | 0.29 | 0.14 | 0.05 | 59.6 |
| 860,146.8750 | 204 | 19.7463 | Agricultural | Miscellaneous Field Crop | Y | N | - | 19.55 | 1.89 | 36.9 | 32,906 | 153,144 | 213 | 0.31 | - | - | 0% | - | | - | - | - | - | - | 213 | 0.31 | 0.15 | 0.03 | 36.9 |
| 864,357.5800 | 93 | 19.8429 | Agricultural | Vineyard | Y | N | - | 19.64 | 2.23 | 43.8 | 39,082 | 120,735 | 168 | 0.24 | - | - | 0% | - | | - | - | - | - | - | 168 | 0.24 | 0.12 | 0.04 | 43.8 |
| 870,368.6150 | 184 | 19.9809 | Agricultural | Miscellaneous Field Crop | Y | N | - | 19.78 | 1.89 | 37.3 | 33,297 | 154,964 | 215 | 0.31 | - | - | 0% | - | | - | - | - | - | - | 215 | 0.31 | 0.15 | 0.03 | 37.3 |
| 874,249.1880 | 199 | 20.0700 | Agricultural | Miscellaneous Field Crop | Y | N | - | 19.87 | 1.89 | 37.5 | 33,445 | 155,655 | 216 | 0.31 | - | - | 0% | - | | - | - | - | - | - | 216 | 0.31 | 0.16 | 0.03 | 37.5 |
| 922,396.4370 | 115 | 21.1753 | Agricultural | Miscellaneous Field Crop | Y | N | - | 20.96 | 1.89 | 39.5 | 35,287 | 164,227 | 228 | 0.33 | - | - | 0% | - | | - | - | - | - | - | 228 | 0.33 | 0.16 | 0.04 | 39.5 |
| 941,479.9380 | 107 | 21.6134 | Agricultural | Miscellaneous Field Crop | Y | N | - | 21.40 | 1.89 | 40.3 | 36,017 | 167,625 | 233 | 0.34 | - | - | 0% | - | | - | - | - | - | - | 233 | 0.34 | 0.17 | 0.04 | 40.3 |
| 944,970.0630 | 150 | 21.6935 | Agricultural | Miscellaneous Field Crop | Y | N | - | 21.48 | 1.89 | 40.5 | 36,151 | 168,246 | 234 | 0.34 | - | - | 0% | - | | - | - | - | - | - | 234 | 0.34 | 0.17 | 0.04 | 40.5 |
| 946,432.3750 | 114 | 21.7271 | Agricultural | Miscellaneous Field Crop | Y | N | - | 21.51 | 1.89 | 40.6 | 36,207 | 168,506 | 234 | 0.34 | - | - | 0% | - | | - | - | - | - | - | 234 | 0.34 | 0.17 | 0.04 | 40.6 |

Attachment B

Table B-1

| | | | | | | Water Meter Information | Irrigation Demand | | | | | | | | WUF-Based Irrigation and Non-Irrigation Demand | | | | | | | | | Total Demand | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Area | Potential User ID | Acres | Category | Name | Existing? | Water Meter Data? | Metered Average Day Demand | Irrigable Area | Unit Irrigation Demand | Irrigation Demand | Average Day Demand | Peak Day Demand | Peak Hour Demand | | WUF | Unadjusted Average Day Demand | $K_{WUF}$ | Adjust Average Day Demand | Additional Demand | Total Average Day Demand | Annual Demand | Peak Day Demand | Peak Hour Demand | | Total Peak Hour Demand | | Total Peak Day Demand | Total Average Annual Demand | |
| (sq. ft.) | | | | | (Y/N) | (Y/N) | (gpd) | (acres) | (AFY/acre) | (AFY) | (gpd) | (gpd) | (gpm) | (mgd) | (gpd/acre) | (gpd) | (%) | (gpd) | (gpd) | (gpd) | (afy) | (gpd) | (gpm) | (mgd) | (gpm) | (mgd) | (mgd) | (mgd) | (afy) |
| 1,013,793.0200 | 212 | 23.2735 | Agricultural | Miscellaneous Field Crop | Y | N | - | 23.04 | 1.89 | 43.4 | 38,783 | 180,500 | 251 | 0.36 | - | - | 0% | - | | - | - | - | - | - | 251 | 0.36 | 0.18 | 0.04 | 43.4 |
| 1,026,800.2500 | 123 | 23.5721 | Agricultural | Orchard | Y | N | - | 23.34 | 3.06 | 71.3 | 63,671 | 172,989 | 240 | 0.35 | - | - | 0% | - | | - | - | - | - | - | 240 | 0.35 | 0.17 | 0.06 | 71.3 |
| 1,033,350.6200 | 200 | 23.7225 | Agricultural | Miscellaneous Field Crop | Y | N | - | 23.49 | 1.89 | 44.3 | 39,532 | 183,982 | 256 | 0.37 | - | - | 0% | - | | - | - | - | - | - | 256 | 0.37 | 0.18 | 0.04 | 44.3 |
| 1,080,740.7600 | 90 | 24.8104 | Agricultural | Vineyard | Y | N | - | 24.56 | 2.23 | 54.7 | 48,866 | 150,960 | 210 | 0.30 | - | - | 0% | - | | - | - | - | - | - | 210 | 0.30 | 0.15 | 0.05 | 54.7 |
| 1,084,771.8700 | 127 | 24.9029 | Agricultural | Miscellaneous Field Crop | Y | N | - | 24.65 | 1.89 | 46.5 | 41,499 | 193,137 | 268 | 0.39 | - | - | 0% | - | | - | - | - | - | - | 268 | 0.39 | 0.19 | 0.04 | 46.5 |
| 1,095,426.6200 | 101 | 25.1475 | Agricultural | Miscellaneous Field Crop | Y | N | - | 24.90 | 1.89 | 46.9 | 41,906 | 195,034 | 271 | 0.39 | - | - | 0% | - | | - | - | - | - | - | 271 | 0.39 | 0.20 | 0.04 | 46.9 |
| 1,098,736.1300 | 131 | 25.2235 | Agricultural | Vineyard | Y | N | - | 24.97 | 2.23 | 55.6 | 49,680 | 153,473 | 213 | 0.31 | - | - | 0% | - | | - | - | - | - | - | 213 | 0.31 | 0.15 | 0.05 | 55.6 |
| 1,109,961.8700 | 156 | 25.4812 | Agricultural | Miscellaneous Field Crop | Y | N | - | 25.23 | 1.89 | 47.6 | 42,462 | 197,622 | 274 | 0.40 | - | - | 0% | - | | - | - | - | - | - | 274 | 0.40 | 0.20 | 0.04 | 47.6 |
| 1,158,498.6900 | 108 | 26.5955 | Agricultural | Orchard | Y | N | - | 26.33 | 3.06 | 80.5 | 71,838 | 195,177 | 271 | 0.39 | - | - | 0% | - | | - | - | - | - | - | 271 | 0.39 | 0.20 | 0.07 | 80.5 |
| 1,186,760.8100 | 172 | 27.2443 | Agricultural | Orchard | Y | N | - | 26.97 | 3.06 | 82.4 | 73,591 | 199,939 | 278 | 0.40 | - | - | 0% | - | | - | - | - | - | - | 278 | 0.40 | 0.20 | 0.07 | 82.4 |
| 1,189,874.3600 | 145 | 27.3158 | Agricultural | Vineyard | Y | N | - | 27.04 | 2.23 | 60.3 | 53,801 | 166,204 | 231 | 0.33 | - | - | 0% | - | | - | - | - | - | - | 231 | 0.33 | 0.17 | 0.05 | 60.3 |
| 1,197,243.3100 | 158 | 27.4849 | Agricultural | Vineyard | Y | N | - | 27.21 | 2.23 | 60.6 | 54,134 | 167,233 | 232 | 0.33 | - | - | 0% | - | | - | - | - | - | - | 232 | 0.33 | 0.17 | 0.05 | 60.6 |
| 1,198,281.0000 | 166 | 27.5087 | Agricultural | Miscellaneous Field Crop | Y | N | - | 27.23 | 1.89 | 51.3 | 45,841 | 213,346 | 296 | 0.43 | - | - | 0% | - | | - | - | - | - | - | 296 | 0.43 | 0.21 | 0.05 | 51.3 |
| 1,224,880.2500 | 163 | 28.1194 | Agricultural | Miscellaneous Field Crop | Y | N | - | 27.84 | 1.89 | 52.5 | 46,859 | 218,082 | 303 | 0.44 | - | - | 0% | - | | - | - | - | - | - | 303 | 0.44 | 0.22 | 0.05 | 52.5 |
| 1,232,501.5100 | 136 | 28.2943 | Agricultural | Vineyard | Y | N | - | 28.01 | 2.23 | 62.4 | 55,728 | 172,158 | 239 | 0.34 | - | - | 0% | - | | - | - | - | - | - | 239 | 0.34 | 0.17 | 0.06 | 62.4 |
| 1,236,009.3800 | 105 | 28.3749 | Agricultural | Miscellaneous Field Crop | Y | N | - | 28.09 | 1.89 | 53.0 | 47,285 | 220,064 | 306 | 0.44 | - | - | 0% | - | | - | - | - | - | - | 306 | 0.44 | 0.22 | 0.05 | 53.0 |
| 1,248,470.7100 | 91 | 28.6609 | Agricultural | Vineyard | Y | N | - | 28.37 | 2.23 | 63.2 | 56,450 | 174,388 | 242 | 0.35 | - | - | 0% | - | | - | - | - | - | - | 242 | 0.35 | 0.17 | 0.06 | 63.2 |
| 1,248,581.8100 | 120 | 28.6635 | Agricultural | Orchard | Y | N | - | 28.38 | 3.06 | 86.7 | 77,424 | 210,354 | 292 | 0.42 | - | - | 0% | - | | - | - | - | - | - | 292 | 0.42 | 0.21 | 0.08 | 86.7 |
| 1,252,159.1200 | 73 | 28.7456 | Agricultural | Vineyard | Y | N | - | 28.46 | 2.23 | 63.4 | 56,617 | 174,904 | 243 | 0.35 | - | - | 0% | - | | - | - | - | - | - | 243 | 0.35 | 0.17 | 0.06 | 63.4 |
| 1,275,580.5000 | 134 | 29.2833 | Agricultural | Vineyard | Y | N | - | 28.99 | 2.23 | 64.6 | 57,676 | 178,175 | 247 | 0.36 | - | - | 0% | - | | - | - | - | - | - | 247 | 0.36 | 0.18 | 0.06 | 64.6 |
| 1,322,910.5900 | 67 | 30.3698 | Agricultural | Orchard | Y | N | - | 30.07 | 3.06 | 91.9 | 82,033 | 222,876 | 310 | 0.45 | - | - | 0% | - | | - | - | - | - | - | 310 | 0.45 | 0.22 | 0.08 | 91.9 |
| 1,407,936.2300 | 89 | 32.3218 | Agricultural | Vineyard | Y | N | - | 32.00 | 2.23 | 71.3 | 63,661 | 196,663 | 273 | 0.39 | - | - | 0% | - | | - | - | - | - | - | 273 | 0.39 | 0.20 | 0.06 | 71.3 |
| 1,426,372.0600 | 118 | 32.7450 | Agricultural | Vineyard | Y | N | - | 32.42 | 2.23 | 72.2 | 64,494 | 199,238 | 277 | 0.40 | - | - | 0% | - | | - | - | - | - | - | 277 | 0.40 | 0.20 | 0.06 | 72.2 |
| 1,428,957.8900 | 122 | 32.8044 | Agricultural | Miscellaneous Field Crop | Y | N | - | 32.48 | 1.89 | 61.2 | 54,666 | 254,417 | 353 | 0.51 | - | - | 0% | - | | - | - | - | - | - | 353 | 0.51 | 0.25 | 0.05 | 61.2 |
| 1,439,733.3500 | 202 | 33.0517 | Agricultural | Orchard | Y | N | - | 32.72 | 3.06 | 100.0 | 89,277 | 242,558 | 337 | 0.49 | - | - | 0% | - | | - | - | - | - | - | 337 | 0.49 | 0.24 | 0.09 | 100.0 |
| 1,446,491.4400 | 160 | 33.2069 | Agricultural | Miscellaneous Field Crop | Y | N | - | 32.87 | 1.89 | 62.0 | 55,337 | 257,539 | 358 | 0.52 | - | - | 0% | - | | - | - | - | - | - | 358 | 0.52 | 0.26 | 0.06 | 62.0 |
| 1,473,689.5600 | 187 | 33.8313 | Agricultural | Orchard | Y | N | - | 33.49 | 3.06 | 102.4 | 91,383 | 248,279 | 345 | 0.50 | - | - | 0% | - | | - | - | - | - | - | 345 | 0.50 | 0.25 | 0.09 | 102.4 |
| 1,504,104.3800 | 176 | 34.5295 | Agricultural | Vineyard | Y | N | - | 34.18 | 2.23 | 76.2 | 68,009 | 210,096 | 292 | 0.42 | - | - | 0% | - | | - | - | - | - | - | 292 | 0.42 | 0.21 | 0.07 | 76.2 |
| 1,570,771.7800 | 102 | 36.0600 | Agricultural | Miscellaneous Field Crop | Y | N | - | 35.70 | 1.89 | 67.3 | 60,091 | 279,666 | 388 | 0.56 | - | - | 0% | - | | - | - | - | - | - | 388 | 0.56 | 0.28 | 0.06 | 67.3 |
| 1,631,762.6900 | 119 | 37.4601 | Agricultural | Orchard | Y | N | - | 37.09 | 3.06 | 113.3 | 101,185 | 274,910 | 382 | 0.55 | - | - | 0% | - | | - | - | - | - | - | 382 | 0.55 | 0.27 | 0.10 | 113.3 |
| 1,660,853.7500 | 111 | 38.1280 | Agricultural | Miscellaneous Field Crop | Y | N | - | 37.75 | 1.89 | 71.2 | 63,537 | 295,705 | 411 | 0.59 | - | - | 0% | - | | - | - | - | - | - | 411 | 0.59 | 0.30 | 0.06 | 71.2 |
| 1,669,045.7500 | 117 | 38.3160 | Agricultural | Vineyard | Y | N | - | 37.93 | 2.23 | 84.5 | 75,467 | 233,135 | 324 | 0.47 | - | - | 0% | - | | - | - | - | - | - | 324 | 0.47 | 0.23 | 0.08 | 84.5 |
| 1,672,101.6200 | 130 | 38.3862 | Agricultural | Vineyard | Y | N | - | 38.00 | 2.23 | 84.7 | 75,605 | 233,562 | 324 | 0.47 | - | - | 0% | - | | - | - | - | - | - | 324 | 0.47 | 0.23 | 0.08 | 84.7 |
| 1,680,888.9700 | 66 | 38.5879 | Agricultural | Miscellaneous Field Crop | Y | N | - | 38.20 | 1.89 | 72.0 | 64,304 | 299,272 | 416 | 0.60 | - | - | 0% | - | | - | - | - | - | - | 416 | 0.60 | 0.30 | 0.06 | 72.0 |
| 1,685,889.7500 | 189 | 38.7027 | Agricultural | Orchard | Y | N | - | 38.32 | 3.06 | 117.1 | 104,541 | 284,029 | 394 | 0.57 | - | - | 0% | - | | - | - | - | - | - | 394 | 0.57 | 0.28 | 0.10 | 117.1 |
| 1,708,159.7500 | 167 | 39.2140 | Agricultural | Miscellaneous Field Crop | Y | N | - | 38.82 | 1.89 | 73.2 | 65,347 | 304,127 | 422 | 0.61 | - | - | 0% | - | | - | - | - | - | - | 422 | 0.61 | 0.30 | 0.07 | 73.2 |
| 1,708,720.8300 | 96 | 39.2268 | Agricultural | Miscellaneous Field Crop | Y | N | - | 38.83 | 1.89 | 73.2 | 65,368 | 304,227 | 423 | 0.61 | - | - | 0% | - | | - | - | - | - | - | 423 | 0.61 | 0.30 | 0.07 | 73.2 |
| 1,718,242.6300 | 97 | 39.4454 | Agricultural | Vineyard | Y | N | - | 39.05 | 2.23 | 87.0 | 77,691 | 240,007 | 333 | 0.48 | - | - | 0% | - | | - | - | - | - | - | 333 | 0.48 | 0.24 | 0.08 | 87.0 |
| 1,944,387.5600 | 132 | 44.6370 | Agricultural | Orchard | Y | N | - | 44.19 | 3.06 | 135.1 | 120,571 | 327,579 | 455 | 0.66 | - | - | 0% | - | | - | - | - | - | - | 455 | 0.66 | 0.33 | 0.12 | 135.1 |
| 2,075,912.5000 | 128 | 47.6564 | Agricultural | Miscellaneous Field Crop | Y | N | - | 47.18 | 1.89 | 89.0 | 79,416 | 369,603 | 513 | 0.74 | - | - | 0% | - | | - | - | - | - | - | 513 | 0.74 | 0.37 | 0.08 | 89.0 |
| 2,095,074.5700 | 137 | 48.0963 | Agricultural | Vineyard | Y | N | - | 47.62 | 2.23 | 106.1 | 94,730 | 292,644 | 406 | 0.59 | - | - | 0% | - | | - | - | - | - | - | 406 | 0.59 | 0.29 | 0.09 | 106.1 |
| 2,136,757.0900 | 143 | 49.0532 | Agricultural | Vineyard | Y | N | - | 48.56 | 2.23 | 108.2 | 96,614 | 298,466 | 415 | 0.60 | - | - | 0% | - | | - | - | - | - | - | 415 | 0.60 | 0.30 | 0.10 | 108.2 |
| 2,136,757.0900 | 143 | 49.0532 | Agricultural | Vineyard | Y | N | - | 48.56 | 2.23 | 108.2 | 96,614 | 298,466 | 415 | 0.60 | - | - | 0% | - | | - | - | - | - | - | 415 | 0.60 | 0.30 | 0.10 | 108.2 |
| 2,204,487.0600 | 155 | 50.6081 | Agricultural | Vineyard | Y | N | - | 50.10 | 2.23 | 111.7 | 99,677 | 307,926 | 428 | 0.62 | - | - | 0% | - | | - | - | - | - | - | 428 | 0.62 | 0.31 | 0.10 | 111.7 |
| 2,211,351.0600 | 112 | 50.7656 | Agricultural | Vineyard | Y | N | - | 50.26 | 2.23 | 112.0 | 99,987 | 308,885 | 429 | 0.62 | - | - | 0% | - | | - | - | - | - | - | 429 | 0.62 | 0.31 | 0.10 | 112.0 |
| 2,218,948.1300 | 165 | 50.9400 | Agricultural | Miscellaneous Field Crop | Y | N | - | 50.43 | 1.89 | 95.1 | 84,888 | 395,070 | 549 | 0.79 | - | - | 0% | - | | - | - | - | - | - | 549 | 0.79 | 0.40 | 0.08 | 95.1 |
| 2,231,585.8800 | 144 | 51.2302 | Agricultural | Vineyard | Y | N | - | 50.72 | 2.23 | 113.0 | 100,902 | 311,712 | 433 | 0.62 | - | - | 0% | - | | - | - | - | - | - | 433 | 0.62 | 0.31 | 0.10 | 113.0 |
| 2,278,917.7700 | 157 | 52.3168 | Agricultural | Miscellaneous Field Crop | Y | N | - | 51.79 | 1.89 | 97.7 | 87,182 | 405,747 | 564 | 0.81 | - | - | 0% | - | | - | - | - | - | - | 564 | 0.81 | 0.41 | 0.09 | 97.7 |
| 2,286,126.0000 | 104 | 52.4822 | Agricultural | Miscellaneous Field Crop | Y | N | - | 51.96 | 1.89 | 98.0 | 87,458 | 407,030 | 565 | 0.81 | - | - | 0% | - | | - | - | - | - | - | 565 | 0.81 | 0.41 | 0.09 | 98.0 |
| 2,327,879.4400 | 159 | 53.4408 | Agricultural | Vineyard | Y | N | - | 52.91 | 2.23 | 117.9 | 105,256 | 325,162 | 452 | 0.65 | - | - | 0% | - | | - | - | - | - | - | 452 | 0.65 | 0.33 | 0.11 | 117.9 |
| 2,476,379.6200 | 110 | 56.8499 | Agricultural | Miscellaneous Field Crop | Y | N | - | 56.28 | 1.89 | 106.1 | 94,736 | 440,904 | 612 | 0.88 | - | - | 0% | - | | - | - | - | - | - | 612 | 0.88 | 0.44 | 0.09 | 106.1 |
| 2,490,542.8100 | 181 | 57.1750 | Agricultural | Vineyard | Y | N | - | 56.60 | 2.23 | 126.1 | 112,611 | 347,883 | 483 | 0.70 | - | - | 0% | - | | - | - | - | - | - | 483 | 0.70 | 0.35 | 0.11 | 126.1 |
| 2,503,036.2500 | 121 | 57.4618 | Agricultural | Miscellaneous Field Crop | Y | N | - | 56.89 | 1.89 | 107.3 | 95,756 | 445,650 | 619 | 0.89 | - | - | 0% | - | | - | - | - | - | - | 619 | 0.89 | 0.45 | 0.10 | 107.3 |
| 2,514,012.0900 | 147 | 57.7138 | Agricultural | Vineyard | Y | N | - | 57.14 | 2.23 | 127.3 | 113,672 | 351,161 | 488 | 0.70 | - | - | 0% | - | | - | - | - | - | - | 488 | 0.70 | 0.35 | 0.11 | 127.3 |
| 2,526,234.6900 | 126 | 57.9944 | Agricultural | Vineyard | Y | N | - | 57.41 | 2.23 | 127.9 | 114,225 | 352,869 | 490 | 0.71 | - | - | 0% | - | | - | - | - | - | - | 490 | 0.71 | 0.35 | 0.11 | 127.9 |
| 2,716,040.8600 | 209 | 62.3517 | Agricultural | Miscellaneous Field Crop | Y | N | - | 61.73 | 1.89 | 116.4 | 103,904 | 483,574 | 672 | 0.97 | - | - | 0% | - | | - | - | - | - | - | 672 | 0.97 | 0.48 | 0.10 | 116.4 |
| 2,940,026.7100 | 210 | 67.4937 | Agricultural | Miscellaneous Field Crop | Y | N | - | 66.82 | 1.89 | 126.0 | 112,473 | 523,453 | 727 | 1.05 | - | - | 0% | - | | - | - | - | - | - | 727 | 1.05 | 0.52 | 0.11 | 126.0 |
| 3,083,549.3200 | 56 | 70.7886 | Agricultural | Orchard | Y | N | - | 70.08 | 3.06 | 214.2 | 191,210 | 519,499 | 722 | 1.04 | - | - | 0% | - | | - | - | - | - | - | 722 | 1.04 | 0.52 | 0.19 | 214.2 |
| 3,318,960.5700 | 138 | 76.1929 | Agricultural | Vineyard | Y | N | - | 75.43 | 2.23 | 168.1 | 150,068 | 463,598 | 644 | 0.93 | - | - | 0% | - | | - | - | - | - | - | 644 | 0.93 | 0.46 | 0.15 | 168.1 |
| 3,327,112.1200 | 129 | 76.3800 | Agricultural | Vineyard | Y | N | - | 75.62 | 2.23 | 168.5 | 150,437 | 464,737 | 645 | 0.93 | - | - | 0% | - | | - | - | - | - | - | 645 | 0.93 | 0.46 | 0.15 | 168.5 |
| 3,381,515.2600 | 139 | 77.6289 | Agricultural | Vineyard | Y | N | - | 76.85 | 2.23 | 171.3 | 152,897 | 472,336 | 656 | 0.94 | - | - | 0% | - | | - | - | - | - | - | 656 | 0.94 | 0.47 | 0.15 | 171.3 |
| 3,443,698.7600 | 141 | 79.0564 | Agricultural | Vineyard | Y | N | - | 78.27 | 2.23 | 174.4 | 155,708 | 481,022 | 668 | 0.96 | - | - | 0% | - | | - | - | - | - | - | 668 | 0.96 | 0.48 | 0.16 | 174.4 |
| 3,462,129.0800 | 140 | 79.4795 | Agricultural | Vineyard | Y | N | - | 78.68 | 2.23 | 175.3 | 156,542 | 483,596 | 672 | 0.97 | - | - | 0% | - | | - | - | - | - | - | 672 | 0.97 | 0.48 | 0.16 | 175.3 |
| 4,231,356.3400 | 72 | 97.1386 | Agricultural | Vineyard | Y | N | - | 96.17 | 2.23 | 214.3 | 191,323 | 591,043 | 821 | 1.18 | - | - | 0% | - | | - | - | - | - | - | 821 | 1.18 | 0.59 | 0.19 | 214.3 |
| 5,338,276.1900 | 109 | 122.5500 | Agricultural | Miscellaneous Field Crop | Y | N | - | 121.32 | 1.89 | 228.8 | 204,220 | 950,447 | 1,320 | 1.90 | - | - | 0% | - | | - | - | - | - | - | 1,320 | 1.90 | 0.95 | 0.20 | 228.8 |
| 5,958,399.1200 | 151 | 136.7860 | Agricultural | Miscellaneous Field Crop | Y | N | - | 135.42 | 1.89 | 255.3 | 227,943 | 1,060,856 | 1,473 | 2.12 | - | - | 0% | - | | - | - | - | - | - | 1,473 | 2.12 | 1.06 | 0.23 | 255.3 |
| 6,717,941.2100 | 71 | 154.2227 | Agricultural | Miscellaneous Field Crop | Y | N | - | 152.68 | 1.89 | 287.9 | 257,000 | 1,196,088 | 1,661 | 2.39 | - | - | 0% | - | | - | - | - | - | - | 1,661 | 2.39 | 1.20 | 0.26 | 287.9 |
| 9,746.7022 | 32 | 0.2238 | Basin/Park | Candy Cane Park | Y | Y | 1,081 | 0.19 | 3.38 | 0.6 | 1,081 | 4,322 | 6 | 0.01 | - | - | 0% | - | | - | - | - | - | - | 6 | 0.01 | 0.00 | 0.00 | 1.2 |
| 23,014.4218 | 24 | 0.5283 | Basin/Park | Maple Square | Y | N | - | 0.45 | 3.38 | 1.5 | 1,357 | 5,427 | 8 | 0.01 | - | - | 0% | - | | - | - | - | - | - | 8 | 0.01 | 0.01 | 0.00 | 1.5 |
| 42,529.5925 | 23 | 0.9763 | Basin/Park | Van Buskirk Park | Y | Y | 3,461 | 0.83 | 3.38 | 2.8 | 3,461 | 13,844 | 19 | 0.03 | - | - | 0% | - | | - | - | - | - | - | 19 | 0.03 | 0.01 | 0.00 | 3.9 |
| 80,272.4108 | 19 | 1.8428 | Basin/Park | Emerson Park | Y | Y | 6,212 | 1.57 | 3.38 | 5.3 | 6,212 | 24,846 | 35 | 0.05 | - | - | 0% | - | | - | - | - | - | - | 35 | 0.05 | 0.02 | 0.01 | 7.0 |
| 89,628.0977 | 43 | 2.0576 | Basin/Park | Westside | N | N | - | 1.75 | 3.38 | 5.9 | 5,284 | 21,136 | 29 | 0.04 | - | - | 0% | - | | - | - | - | - | - | 29 | 0.04 | 0.02 | 0.01 | 5.9 |
| 104,587.5640 | 25 | 2.4010 | Basin/Park | Armory Park | Y | Y | 4,871 | 2.04 | 3.38 | 6.9 | 4,871 | 19,484 | 27 | 0.04 | - | - | 0% | - | | - | - | - | - | - | 27 | 0.04 | 0.02 | 0.00 | 5.5 |
| 110,509.4850 | 27 | 2.5369 | Basin/Park | Century Park | Y | N | - | 2.16 | 3.38 | 7.3 | 6,515 | 26,060 | 36 | 0.05 | - | - | 0% | - | | - | - | - | - | - | 36 | 0.05 | 0.03 | 0.01 | 7.3 |
| 115,268.8010 | 22 | 2.6462 | Basin/Park | Hale Park | Y | Y | 5,845 | 2.25 | 3.38 | 7.6 | 5,845 | 23,381 | 32 | 0.05 | - | - | 0% | - | | - | - | - | - | - | 32 | 0.05 | 0.02 | 0.01 | 6.5 |
| 116,637.8420 | 3 | 2.6776 | Basin/Park | Century Meadows Park | Y | N | - | 2.28 | 3.38 | 7.7 | 6,876 | 27,505 | 38 | 0.06 | - | - | 0% | - | | - | - | - | - | - | 38 | 0.06 | 0.03 | 0.01 | 7.7 |
| 132,947.3470 | 339 | 3.0521 | Basin/Park | Southwest Gateway | Y | N | - | 2.59 | 3.38 | 8.8 | 7,838 | 31,351 | 44 | 0.06 | - | - | 0% | - | | - | - | - | - | - | 44 | 0.06 | 0.03 | 0.01 | 8.8 |
| 136,250.6570 | 48 | 3.1279 | Basin/Park | Southwest Gateway | N | N | - | 2.66 | 3.38 | 9.0 | 8,033 | 32,130 | 45 | 0.06 | - | - | 0% | - | | - | - | - | - | - | 45 | 0.06 | 0.03 | 0.01 | 9.0 |
| 164,375.4660 | 33 | 3.7735 | Basin/Park | English Oaks Park | Y | Y | 9,156 | 3.21 | 3.38 | 10.9 | 9,156 | 36,624 | 51 | 0.07 | - | - | 0% | - | | - | - | - | - | - | 51 | 0.07 | 0.04 | 0.01 | 10.3 |
| 209,237.2610 | 4 | 4.8034 | Basin/Park | Katzakian Park | Y | Y | 16,807 | 4.08 | 3.38 | 13.8 | 16,807 | 67,229 | 93 | 0.13 | - | - | 0% | - | | - | - | - | - | - | 93 | 0.13 | 0.07 | 0.02 | 18.8 |
| 235,614.6090 | 49 | 5.4090 | Basin/Park | Reynolds Ranch | N | N | - | 4.60 | 3.38 | 15.6 | 13,891 | 55,562 | 77 | 0.11 | - | - | 0% | - | | - | - | - | - | - | 77 | 0.11 | 0.06 | 0.01 | 15.6 |
| 242,724.7270 | 50 | 5.5722 | Basin/Park | Reynolds Ranch | N | N | - | 4.74 | 3.38 | 16.0 | 14,310 | 57,239 | 79 | 0.11 | - | - | 0% | - | | - | - | - | - | - | 79 | 0.11 | 0.06 | 0.01 | 16.0 |
| 242,857.1020 | 30 | 5.5752 | Basin/Park | Legion Park | Y | Y | 9,533 | 4.74 | 3.38 | 16.0 | 9,533 | 38,133 | 53 | 0.08 | - | - | 0% | - | | - | - | - | - | - | 53 | 0.08 | 0.04 | 0.01 | 10.7 |
| 243,878.7730 | 42 | 5.5987 | Basin/Park | Westside | N | N | - | 4.76 | 3.38 | 16.1 | 14,378 | 57,511 | 80 | 0.12 | - | - | 0% | - | | - | - | - | - | - | 80 | 0.12 | 0.06 | 0.01 | 16.1 |
| 259,697.2170 | 46 | 5.9618 | Basin/Park | Southwest Gateway | N | N | - | 5.07 | 3.38 | 17.1 | 15,310 | 61,241 | 85 | 0.12 | - | - | 0% | - | | - | - | - | - | - | 85 | 0.12 | 0.06 | 0.02 | 17.1 |
| 265,195.4470 | 47 | 6.0880 | Basin/Park | Southwest Gateway | N | N | - | 5.17 | 3.38 | 17.5 | 15,634 | 62,538 | 87 | 0.13 | - | - | 0% | - | | - | - | - | - | - | 87 | 0.13 | 0.06 | 0.02 | 17.5 |
| 309,115.4230 | 21 | 7.0963 | Basin/Park | Softball Complex | Y | Y | 22,462 | 6.03 | 3.38 | 20.4 | 22,462 | 89,848 | 125 | 0.18 | - | - | 0% | - | | - | - | - | - | - | 125 | 0.18 | 0.09 | 0.02 | 25.2 |
| 350,366.5820 | 2 | 8.0433 | Basin/Park | Roget Park | Y | N | - | 6.84 | 3.38 | 23.1 | 20,656 | 82,623 | 115 | 0.17 | - | - | 0% | - | | - | - | - | - | - | 115 | 0.17 | 0.08 | 0.02 | 23.1 |
| 366,367.5340 | 29 | 8.4106 | Basin/Park | John Blakely Park | Y | Y | 17,520 | 7.15 | 3.38 | 24.2 | 17,520 | 70,079 | 97 | 0.14 | - | - | 0% | - | | - | - | - | - | - | 97 | 0.14 | 0.07 | 0.02 | 19.6 |
| 404,298.9410 | 26 | 9.2814 | Basin/Park | Lawrence Park | Y | Y | 12,258 | 7.89 | 3.38 | 26.7 | 12,258 | 49,032 | 68 | 0.10 | - | - | 0% | - | | - | - | - | - | - | 68 | 0.10 | 0.05 | 0.01 | 13.7 |
| 431,784.3780 | 31 | 9.9124 | Basin/Park | Hutchins Street Square | Y | N | - | 8.43 | 3.38 | 28.5 | 25,456 | 101,822 | 141 | 0.20 | - | - | 0% | - | | - | - | - | - | - | 141 | 0.20 | 0.10 | 0.03 | 28.5 |
| 489,573.0300 | 224 | 11.2391 | Basin/Park | Grape Bowl | Y | Y | 2,521 | 9.55 | 3.38 | 32.3 | 2,521 | 10,084 | 14 | 0.02 | - | - | 0% | - | | - | - | - | - | - | 14 | 0.02 | 0.01 | 0.00 | 2.8 |
| 499,886.3460 | 44 | 11.4758 | Basin/Park | Westside | N | N | - | 9.75 | 3.38 | 33.0 | 29,470 | 117,882 | 164 | 0.24 | - | - | 0% | - | | - | - | - | - | - | 164 | 0.24 | 0.12 | 0.03 | 33.0 |
| 524,622.9640 | 38 | 12.0437 | Basin/Park | Vinewood Park | Y | Y | 30,566 | 10.24 | 3.38 | 34.6 | 30,566 | 122,262 | 170 | 0.24 | - | - | 0% | - | | - | - | - | - | - | 170 | 0.24 | 0.12 | 0.03 | 34.2 |
| 561,766.6760 | 34 | 12.8964 | Basin/Park | Kofu Park | Y | N | - | 10.96 | 3.38 | 37.1 | 33,119 | 132,474 | 184 | 0.26 | - | - | 0% | - | | - | - | - | - | - | 184 | 0.26 | 0.13 | 0.03 | 37.1 |
| 572,823.3460 | 36 | 13.1502 | Basin/Park | Henry Glaves Park | Y | N | - | 11.18 | 3.38 | 37.8 | 33,770 | 135,082 | 188 | 0.27 | - | - | 0% | - | | - | - | - | - | - | 188 | 0.27 | 0.14 | 0.03 | 37.8 |
| 599,861.3930 | 45 | 13.7709 | Basin/Park | Southwest Gateway | N | N | - | 11.71 | 3.38 | 39.6 | 35,364 | 141,458 | 196 | 0.28 | - | - | 0% | - | | - | - | - | - | - | 196 | 0.28 | 0.14 | 0.04 | 39.6 |
| 602,726.0410 | 35 | 13.8367 | Basin/Park | Beckman Park | Y | N | - | 11.76 | 3.38 | 39.8 | 35,533 | 142,133 | 197 | 0.28 | - | - | 0% | - | | - | - | - | - | - | 197 | 0.28 | 0.14 | 0.04 | 39.8 |
| 906,711.0810 | 37 | 20.8152 | Basin/Park | Peterson Park | Y | Y | 62,370 | 17.69 | 3.38 | 59.9 | 62,370 | 249,479 | 346 | 0.50 | - | - | 0% | - | | - | - | - | - | - | 346 | 0.50 | 0.25 | 0.08 | 69.9 |

Attachment B

Table B-1

| | | | | | | Water Meter Information | Irrigation Demand | | | | | | | | WUF-Based Irrigation and Non-Irrigation Demand | | | | | | | | | Total Demand | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Area | Potential User ID | Acres | Category | Name | Existing? | Water Meter Data? | Metered Average Day Demand | Irrigable Area | Unit Irrigation Demand | Irrigation Demand | Average Day Demand | Peak Day Demand | Peak Hour Demand | | WUF | Unadjusted Average Day Demand | $K_{WUF}$ | Adjust Average Day Demand | Additional Demand | Total Average Day Demand | Annual Demand | Peak Day Demand | Peak Hour Demand | | Total Peak Hour Demand | | Total Peak Day Demand | Total Average Annual Demand | |
| (sq. ft.) | | | | | (Y/N) | (Y/N) | (gpd) | (acres) | (AFY/acre) | (AFY) | (gpd) | (gpd) | (gpm) | (mgd) | (gpd/acre) | (gpd) | (%) | (gpd) | (gpd) | (gpd) | (afy) | (gpd) | (gpm) | (mgd) | (gpm) | (mgd) | (mgd) | (mgd) | (afy) |
| 908,501.0010 | 28 | 20.8563 | Basin/Park | Samuel D. Salas Park | Y | N | - | 17.73 | 3.38 | 60.0 | 53,560 | 214,241 | 298 | 0.43 | - | - | 0% | - | | - | - | - | - | - | 298 | 0.43 | 0.21 | 0.05 | 60.0 |
| 1,155,884.0700 | 20 | 26.5354 | Basin/Park | Pixley Park | Y | Y | 22 | 22.56 | 3.38 | 76.3 | 22 | 89 | 0 | 0.00 | - | - | 0% | - | | - | - | - | - | - | 0 | 0.00 | 0.00 | 0.00 | 0.0 |
| 1,776,487.6400 | 223 | 40.7825 | Basin/Park | Lodi Lake Park & Wilderness Area | Y | Y | 32,108 | 34.67 | 3.38 | 117.3 | 32,108 | 128,430 | 178 | 0.26 | - | - | 0% | - | | - | - | - | - | - | 178 | 0.26 | 0.13 | 0.03 | 36.0 |
| 1,985,986.8000 | 6 | 45.5920 | Basin/Park | DeBenedetti Park | N | N | - | 38.75 | 3.38 | 131.1 | 117,083 | 468,331 | 650 | 0.94 | - | - | 0% | - | | - | - | - | - | - | 650 | 0.94 | 0.47 | 0.12 | 131.1 |
| 861,768.5620 | 226 | 19.7835 | Cemetery | Lodi Memorial Cemetery | Y | N | - | 16.82 | 3.38 | 56.9 | 50,805 | 118,953 | 165 | 0.24 | - | - | 0% | - | | - | - | - | - | - | 165 | 0.24 | 0.12 | 0.05 | 56.9 |
| 1,569,256.5100 | 227 | 36.0252 | Cemetery | Cherokee Memorial Park | Y | N | - | 30.62 | 3.38 | 103.6 | 92,515 | 216,610 | 301 | 0.43 | - | - | 0% | - | | - | - | - | - | - | 301 | 0.43 | 0.22 | 0.09 | 103.6 |
| 416,103.0130 | 349 | 9.5524 | Church | St. John's Episcopal | Y | N | - | 3.82 | 3.38 | 12.9 | 11,544 | 27,029 | 56 | 0.08 | - | - | 0% | - | | - | - | - | - | - | 56 | 0.08 | 0.03 | 0.01 | 12.9 |
| 38,478.1420 | 305 | 0.8833 | Commercial | C-S | N | N | - | - | 3.38 | 0.0 | - | - | - | 0.00 | 2,750 | 2,429 | 5% | 121 | | 121 | 0.1 | 284 | 0.4 | 0.00 | 0.4 | 0.0006 | 0.0003 | 0.0001 | 0.1 |
| 41,253.2481 | 229 | 0.9470 | Commercial | C-1 | N | N | - | - | 3.38 | 0.0 | - | - | - | 0.00 | 2,750 | 2,604 | 5% | 130 | | 130 | 0.1 | 305 | 0.4 | 0.00 | 0.4 | 0.0006 | 0.0003 | 0.0001 | 0.1 |
| 51,867.4731 | 304 | 1.1907 | Commercial | C-S | N | N | - | - | 3.38 | 0.0 | - | - | - | 0.00 | 2,750 | 3,274 | 5% | 164 | | 164 | 0.2 | 383 | 0.5 | 0.00 | 0.5 | 0.0008 | 0.0004 | 0.0002 | 0.2 |
| 56,490.3797 | 302 | 1.2968 | Commercial | C-S | N | N | - | - | 3.38 | 0.0 | - | - | - | 0.00 | 2,750 | 3,566 | 5% | 178 | | 178 | 0.2 | 418 | 0.6 | 0.00 | 0.6 | 0.0008 | 0.0004 | 0.0002 | 0.2 |
| 75,932.5301 | 303 | 1.7432 | Commercial | C-S | N | N | - | - | 3.38 | 0.0 | - | - | - | 0.00 | 2,750 | 4,794 | 5% | 240 | | 240 | 0.3 | 561 | 0.8 | 0.00 | 0.8 | 0.0011 | 0.0006 | 0.0002 | 0.3 |
| 83,280.5625 | 306 | 1.9119 | Commercial | C-S | N | N | - | - | 3.38 | 0.0 | - | - | - | 0.00 | 2,750 | 5,258 | 5% | 263 | | 263 | 0.3 | 615 | 0.9 | 0.00 | 0.9 | 0.0012 | 0.0006 | 0.0003 | 0.3 |
| 83,471.5565 | 294 | 1.9162 | Commercial | C-2 | N | N | - | - | 3.38 | 0.0 | - | - | - | 0.00 | 2,750 | 5,270 | 5% | 263 | | 263 | 0.3 | 617 | 0.9 | 0.00 | 0.9 | 0.0012 | 0.0006 | 0.0003 | 0.3 |
| 87,316.7746 | 307 | 2.0045 | Commercial | C-S | N | N | - | - | 3.38 | 0.0 | - | - | - | 0.00 | 2,750 | 5,512 | 5% | 276 | | 276 | 0.3 | 645 | 0.9 | 0.00 | 0.9 | 0.0013 | 0.0006 | 0.0003 | 0.3 |
| 303,373.5130 | 300 | 6.9645 | Commercial | C-S | N | N | - | - | 3.38 | 0.0 | - | - | - | 0.00 | 2,750 | 19,152 | 5% | 958 | | 958 | 1.1 | 2,242 | 3.1 | 0.00 | 3.1 | 0.0045 | 0.0022 | 0.0010 | 1.1 |
| 357,422.6900 | 301 | 8.2053 | Commercial | C-S | N | N | - | - | 3.38 | 0.0 | - | - | - | 0.00 | 2,750 | 22,565 | 5% | 1,128 | | 1,128 | 1.3 | 2,642 | 3.7 | 0.01 | 3.7 | 0.0053 | 0.0026 | 0.0011 | 1.3 |
| 510,374.6880 | 308 | 11.7166 | Commercial | C-S | N | N | - | - | 3.38 | 0.0 | - | - | - | 0.00 | 2,750 | 32,221 | 5% | 1,611 | | 1,611 | 1.8 | 3,772 | 5.2 | 0.01 | 5.2 | 0.0075 | 0.0038 | 0.0016 | 1.8 |
| 582,061.4050 | 40 | 13.3623 | Commercial | Mainland Nursery | Y | N | - | 10.02 | 3.38 | 33.9 | 30,278 | 70,892 | 148 | 0.21 | - | - | 0% | - | | - | - | - | - | - | 148 | 0.21 | 0.07 | 0.03 | 33.9 |
| 796,466.3460 | 299 | 18.2844 | Commercial | C-S | N | N | - | - | 3.38 | 0.0 | - | - | - | 0.00 | 2,750 | 50,282 | 5% | 2,514 | | 2,514 | 2.8 | 5,886 | 8.2 | 0.01 | 8.2 | 0.0118 | 0.0059 | 0.0025 | 2.8 |
| 978,659.3510 | 220 | 22.4669 | Commercial | Blue Shield Call Center | N | N | - | - | 3.38 | 0.0 | - | - | - | 0.00 | 2,750 | 61,784 | 5% | 3,089 | | 3,089 | 3.5 | 7,233 | 10.0 | 0.01 | 10 | 0.01 | 0.01 | 0.00 | 3.5 |
| 2,023,331.2600 | 346 | 46.4493 | Commercial | Reynolds Ranch | N | N | - | - | 3.38 | 0.0 | - | - | - | 0.00 | 2,750 | 127,736 | 5% | 6,387 | | 6,387 | 7.2 | 14,954 | 20.8 | 0.03 | 21 | 0.0299 | 0.0150 | 0.01 | 7.2 |
| 5,211.3929 | 320 | 0.1196 | Industrial | M-2 | N | N | - | - | 3.38 | 0.0 | - | - | - | 0.00 | 2,200 | 263 | 5% | 13 | | 13 | 0.0 | 31 | 0.0 | 0.00 | 0 | 0.00 | 0.00 | 0.00 | 0.0 |
| 6,955.2392 | 321 | 0.1597 | Industrial | M-2 | N | N | - | - | 3.38 | 0.0 | - | - | - | 0.00 | 2,200 | 351 | 5% | 18 | | 18 | 0.0 | 41 | 0.1 | 0.00 | 0 | 0.00 | 0.00 | 0.00 | 0.0 |
| 7,431.5183 | 318 | 0.1706 | Industrial | M-2 | N | N | - | - | 3.38 | 0.0 | - | - | - | 0.00 | 2,200 | 375 | 5% | 19 | | 19 | 0.0 | 44 | 0.1 | 0.00 | 0 | 0.00 | 0.00 | 0.00 | 0.0 |
| 7,584.7635 | 317 | 0.1741 | Industrial | M-2 | N | N | - | - | 3.38 | 0.0 | - | - | - | 0.00 | 2,200 | 383 | 5% | 19 | | 19 | 0.0 | 45 | 0.1 | 0.00 | 0 | 0.00 | 0.00 | 0.00 | 0.0 |
| 8,194.0867 | 319 | 0.1881 | Industrial | M-2 | N | N | - | - | 3.38 | 0.0 | - | - | - | 0.00 | 2,200 | 414 | 5% | 21 | | 21 | 0.0 | 48 | 0.1 | 0.00 | 0 | 0.00 | 0.00 | 0.00 | 0.0 |
| 12,674.2294 | 316 | 0.2910 | Industrial | M-2 | N | N | - | - | 3.38 | 0.0 | - | - | - | 0.00 | 2,200 | 640 | 5% | 32 | | 32 | 0.0 | 75 | 0.1 | 0.00 | 0 | 0.00 | 0.00 | 0.00 | 0.0 |
| 17,111.1053 | 256 | 0.3928 | Industrial | M-2 | N | N | - | - | 3.38 | 0.0 | - | - | - | 0.00 | 2,200 | 864 | 5% | 43 | | 43 | 0.0 | 101 | 0.1 | 0.00 | 0 | 0.00 | 0.00 | 0.00 | 0.0 |
| 20,961.5175 | 249 | 0.4812 | Industrial | M-1 | N | N | - | - | 3.38 | 0.0 | - | - | - | 0.00 | 2,200 | 1,059 | 5% | 53 | | 53 | 0.1 | 124 | 0.2 | 0.00 | 0 | 0.00 | 0.00 | 0.00 | 0.1 |
| 20,996.7489 | 279 | 0.4820 | Industrial | M-1 | N | N | - | - | 3.38 | 0.0 | - | - | - | 0.00 | 2,200 | 1,060 | 5% | 53 | | 53 | 0.1 | 124 | 0.2 | 0.00 | 0 | 0.00 | 0.00 | 0.00 | 0.1 |
| 20,996.7489 | 280 | 0.4820 | Industrial | M-1 | N | N | - | - | 3.38 | 0.0 | - | - | - | 0.00 | 2,200 | 1,060 | 5% | 53 | | 53 | 0.1 | 124 | 0.2 | 0.00 | 0 | 0.00 | 0.00 | 0.00 | 0.1 |
| 21,675.9253 | 237 | 0.4976 | Industrial | M-2 | N | N | - | - | 3.38 | 0.0 | - | - | - | 0.00 | 2,200 | 1,095 | 5% | 55 | | 55 | 0.1 | 128 | 0.2 | 0.00 | 0 | 0.00 | 0.00 | 0.00 | 0.1 |
| 21,681.8384 | 282 | 0.4977 | Industrial | M-1 | N | N | - | - | 3.38 | 0.0 | - | - | - | 0.00 | 2,200 | 1,095 | 5% | 55 | | 55 | 0.1 | 128 | 0.2 | 0.00 | 0 | 0.00 | 0.00 | 0.00 | 0.1 |
| 21,739.6040 | 257 | 0.4991 | Industrial | M-2 | N | N | - | - | 3.38 | 0.0 | - | - | - | 0.00 | 2,200 | 1,098 | 5% | 55 | | 55 | 0.1 | 129 | 0.2 | 0.00 | 0 | 0.00 | 0.00 | 0.00 | 0.1 |
| 21,797.4914 | 281 | 0.5004 | Industrial | M-1 | N | N | - | - | 3.38 | 0.0 | - | - | - | 0.00 | 2,200 | 1,101 | 5% | 55 | | 55 | 0.1 | 129 | 0.2 | 0.00 | 0 | 0.00 | 0.00 | 0.00 | 0.1 |
| 22,285.9902 | 315 | 0.5116 | Industrial | M-2 | N | N | - | - | 3.38 | 0.0 | - | - | - | 0.00 | 2,200 | 1,126 | 5% | 56 | | 56 | 0.1 | 132 | 0.2 | 0.00 | 0 | 0.00 | 0.00 | 0.00 | 0.1 |
| 22,784.4720 | 285 | 0.5231 | Industrial | M-1 | N | N | - | - | 3.38 | 0.0 | - | - | - | 0.00 | 2,200 | 1,151 | 5% | 58 | | 58 | 0.1 | 135 | 0.2 | 0.00 | 0 | 0.00 | 0.00 | 0.00 | 0.1 |
| 22,820.7382 | 288 | 0.5239 | Industrial | M-1 | N | N | - | - | 3.38 | 0.0 | - | - | - | 0.00 | 2,200 | 1,153 | 5% | 58 | | 58 | 0.1 | 135 | 0.2 | 0.00 | 0 | 0.00 | 0.00 | 0.00 | 0.1 |
| 22,889.2711 | 286 | 0.5255 | Industrial | M-1 | N | N | - | - | 3.38 | 0.0 | - | - | - | 0.00 | 2,200 | 1,156 | 5% | 58 | | 58 | 0.1 | 135 | 0.2 | 0.00 | 0 | 0.00 | 0.00 | 0.00 | 0.1 |
| 22,956.1723 | 290 | 0.5270 | Industrial | M-1 | N | N | - | - | 3.38 | 0.0 | - | - | - | 0.00 | 2,200 | 1,159 | 5% | 58 | | 58 | 0.1 | 136 | 0.2 | 0.00 | 0 | 0.00 | 0.00 | 0.00 | 0.1 |
| 23,192.1081 | 239 | 0.5324 | Industrial | M-2 | N | N | - | - | 3.38 | 0.0 | - | - | - | 0.00 | 2,200 | 1,171 | 5% | 59 | | 59 | 0.1 | 137 | 0.2 | 0.00 | 0 | 0.00 | 0.00 | 0.00 | 0.1 |
| 23,923.6956 | 287 | 0.5492 | Industrial | M-1 | N | N | - | - | 3.38 | 0.0 | - | - | - | 0.00 | 2,200 | 1,208 | 5% | 60 | | 60 | 0.1 | 141 | 0.2 | 0.00 | 0 | 0.00 | 0.00 | 0.00 | 0.1 |
| 23,923.6956 | 289 | 0.5492 | Industrial | M-1 | N | N | - | - | 3.38 | 0.0 | - | - | - | 0.00 | 2,200 | 1,208 | 5% | 60 | | 60 | 0.1 | 141 | 0.2 | 0.00 | 0 | 0.00 | 0.00 | 0.00 | 0.1 |
| 24,815.0599 | 241 | 0.5697 | Industrial | M-2 | N | N | - | - | 3.38 | 0.0 | - | - | - | 0.00 | 2,200 | 1,253 | 5% | 63 | | 63 | 0.1 | 147 | 0.2 | 0.00 | 0 | 0.00 | 0.00 | 0.00 | 0.1 |
| 24,838.2345 | 247 | 0.5702 | Industrial | M-1 | N | N | - | - | 3.38 | 0.0 | - | - | - | 0.00 | 2,200 | 1,254 | 5% | 63 | | 63 | 0.1 | 147 | 0.2 | 0.00 | 0 | 0.00 | 0.00 | 0.00 | 0.1 |
| 24,907.2573 | 248 | 0.5718 | Industrial | M-1 | N | N | - | - | 3.38 | 0.0 | - | - | - | 0.00 | 2,200 | 1,258 | 5% | 63 | | 63 | 0.1 | 147 | 0.2 | 0.00 | 0 | 0.00 | 0.00 | 0.00 | 0.1 |
| 24,914.4478 | 238 | 0.5720 | Industrial | M-2 | N | N | - | - | 3.38 | 0.0 | - | - | - | 0.00 | 2,200 | 1,258 | 5% | 63 | | 63 | 0.1 | 147 | 0.2 | 0.00 | 0 | 0.00 | 0.00 | 0.00 | 0.1 |
| 25,235.8259 | 283 | 0.5793 | Industrial | M-1 | N | N | - | - | 3.38 | 0.0 | - | - | - | 0.00 | 2,200 | 1,275 | 5% | 64 | | 64 | 0.1 | 149 | 0.2 | 0.00 | 0 | 0.00 | 0.00 | 0.00 | 0.1 |
| 25,676.9179 | 235 | 0.5895 | Industrial | M-2 | N | N | - | - | 3.38 | 0.0 | - | - | - | 0.00 | 2,200 | 1,297 | 5% | 65 | | 65 | 0.1 | 152 | 0.2 | 0.00 | 0 | 0.00 | 0.00 | 0.00 | 0.1 |
| 25,872.5335 | 284 | 0.5940 | Industrial | M-1 | N | N | - | - | 3.38 | 0.0 | - | - | - | 0.00 | 2,200 | 1,307 | 5% | 65 | | 65 | 0.1 | 153 | 0.2 | 0.00 | 0 | 0.00 | 0.00 | 0.00 | 0.1 |
| 26,392.5485 | 246 | 0.6059 | Industrial | M-1 | N | N | - | - | 3.38 | 0.0 | - | - | - | 0.00 | 2,200 | 1,333 | 5% | 67 | | 67 | 0.1 | 156 | 0.2 | 0.00 | 0 | 0.00 | 0.00 | 0.00 | 0.1 |
| 26,934.9311 | 296 | 0.6183 | Industrial | M-2 | N | N | - | - | 3.38 | 0.0 | - | - | - | 0.00 | 2,200 | 1,360 | 5% | 68 | | 68 | 0.1 | 159 | 0.2 | 0.00 | 0 | 0.00 | 0.00 | 0.00 | 0.1 |
| 31,789.2940 | 240 | 0.7298 | Industrial | M-2 | N | N | - | - | 3.38 | 0.0 | - | - | - | 0.00 | 2,200 | 1,606 | 5% | 80 | | 80 | 0.1 | 188 | 0.3 | 0.00 | 0 | 0.00 | 0.00 | 0.00 | 0.1 |
| 32,006.9713 | 260 | 0.7348 | Industrial | M-2 | N | N | - | - | 3.38 | 0.0 | - | - | - | 0.00 | 2,200 | 1,617 | 5% | 81 | | 81 | 0.1 | 189 | 0.3 | 0.00 | 0 | 0.00 | 0.00 | 0.00 | 0.1 |
| 32,999.7278 | 262 | 0.7576 | Industrial | M-2 | N | N | - | - | 3.38 | 0.0 | - | - | - | 0.00 | 2,200 | 1,667 | 5% | 83 | | 83 | 0.1 | 195 | 0.3 | 0.00 | 0 | 0.00 | 0.00 | 0.00 | 0.1 |
| 33,704.9419 | 258 | 0.7738 | Industrial | M-2 | N | N | - | - | 3.38 | 0.0 | - | - | - | 0.00 | 2,200 | 1,702 | 5% | 85 | | 85 | 0.1 | 199 | 0.3 | 0.00 | 0 | 0.00 | 0.00 | 0.00 | 0.1 |
| 34,360.3303 | 236 | 0.7888 | Industrial | M-2 | N | N | - | - | 3.38 | 0.0 | - | - | - | 0.00 | 2,200 | 1,735 | 5% | 87 | | 87 | 0.1 | 203 | 0.3 | 0.00 | 0 | 0.00 | 0.00 | 0.00 | 0.1 |
| 35,409.5841 | 293 | 0.8129 | Industrial | M-1 | N | N | - | - | 3.38 | 0.0 | - | - | - | 0.00 | 2,200 | 1,788 | 5% | 89 | | 89 | 0.1 | 209 | 0.3 | 0.00 | 0 | 0.00 | 0.00 | 0.00 | 0.1 |
| 37,551.2170 | 259 | 0.8621 | Industrial | M-2 | N | N | - | - | 3.38 | 0.0 | - | - | - | 0.00 | 2,200 | 1,897 | 5% | 95 | | 95 | 0.1 | 222 | 0.3 | 0.00 | 0 | 0.00 | 0.00 | 0.00 | 0.1 |
| 38,219.4708 | 264 | 0.8774 | Industrial | M-2 | N | N | - | - | 3.38 | 0.0 | - | - | - | 0.00 | 2,200 | 1,930 | 5% | 97 | | 97 | 0.1 | 226 | 0.3 | 0.00 | 0 | 0.00 | 0.00 | 0.00 | 0.1 |
| 41,448.5448 | 295 | 0.9515 | Industrial | M-2 | N | N | - | - | 3.38 | 0.0 | - | - | - | 0.00 | 2,200 | 2,093 | 5% | 105 | | 105 | 0.1 | 245 | 0.3 | 0.00 | 0 | 0.00 | 0.00 | 0.00 | 0.1 |
| 41,651.2402 | 265 | 0.9562 | Industrial | M-2 | N | N | - | - | 3.38 | 0.0 | - | - | - | 0.00 | 2,200 | 2,104 | 5% | 105 | | 105 | 0.1 | 246 | 0.3 | 0.00 | 0 | 0.00 | 0.00 | 0.00 | 0.1 |
| 43,059.3355 | 266 | 0.9885 | Industrial | M-2 | N | N | - | - | 3.38 | 0.0 | - | - | - | 0.00 | 2,200 | 2,175 | 5% | 109 | | 109 | 0.1 | 255 | 0.4 | 0.00 | 0 | 0.00 | 0.00 | 0.00 | 0.1 |
| 61,446.8742 | 261 | 1.4106 | Industrial | M-2 | N | N | - | - | 3.38 | 0.0 | - | - | - | 0.00 | 2,200 | 3,103 | 5% | 155 | | 155 | 0.2 | 363 | 0.5 | 0.00 | 1 | 0.00 | 0.00 | 0.00 | 0.2 |
| 77,808.8213 | 278 | 1.7862 | Industrial | M-1 | N | N | - | - | 3.38 | 0.0 | - | - | - | 0.00 | 2,200 | 3,930 | 5% | 196 | | 196 | 0.2 | 460 | 0.6 | 0.00 | 1 | 0.00 | 0.00 | 0.00 | 0.2 |
| 83,449.0660 | 250 | 1.9157 | Industrial | M-1 | N | N | - | - | 3.38 | 0.0 | - | - | - | 0.00 | 2,200 | 4,215 | 5% | 211 | | 211 | 0.2 | 493 | 0.7 | 0.00 | 1 | 0.00 | 0.00 | 0.00 | 0.2 |
| 89,736.7388 | 292 | 2.0601 | Industrial | M-1 | N | N | - | - | 3.38 | 0.0 | - | - | - | 0.00 | 2,200 | 4,532 | 5% | 227 | | 227 | 0.3 | 531 | 0.7 | 0.00 | 1 | 0.00 | 0.00 | 0.00 | 0.3 |
| 99,918.2659 | 221 | 2.2938 | Industrial | Potential NCPA Plant | N | N | - | - | 3.38 | 0.0 | - | - | - | 0.00 | 2,200 | 5,046 | 5% | 252 | 1,700,000 | 1,700,252 | 1,904.5 | 2,500,000 | 1,736.1 | 2.50 | 1,736 | 2.50 | 2.50 | 1.36 | 1,523.6 |
| 104,861.2700 | 242 | 2.4073 | Industrial | M-1 | N | N | - | - | 3.38 | 0.0 | - | - | - | 0.00 | 2,200 | 5,296 | 5% | 265 | | 265 | 0.3 | 620 | 0.9 | 0.00 | 1 | 0.00 | 0.00 | 0.00 | 0.3 |
| 130,551.5800 | 263 | 2.9971 | Industrial | M-2 | N | N | - | - | 3.38 | 0.0 | - | - | - | 0.00 | 2,200 | 6,594 | 5% | 330 | | 330 | 0.4 | 772 | 1.1 | 0.00 | 1 | 0.00 | 0.00 | 0.00 | 0.4 |
| 135,378.5790 | 272 | 3.1079 | Industrial | M-2 | N | N | - | - | 3.38 | 0.0 | - | - | - | 0.00 | 2,200 | 6,837 | 5% | 342 | | 342 | 0.4 | 800 | 1.1 | 0.00 | 1 | 0.00 | 0.00 | 0.00 | 0.4 |
| 147,318.5210 | 54 | 3.3820 | Industrial | NCPA Power Plant | Y | N | - | - | 3.38 | 0.0 | - | - | - | 0.00 | 2,200 | 7,440 | 5% | 372 | 500,000 | 500,372 | 560.5 | - | - | - | - | - | 0.07 | 76.7 |
| 164,617.4880 | 251 | 3.7791 | Industrial | M-1 | N | N | - | - | 3.38 | 0.0 | - | - | - | 0.00 | 2,200 | 8,314 | 5% | 416 | | 416 | 0.5 | 973 | 1.4 | 0.00 | 1 | 0.00 | 0.00 | 0.00 | 0.5 |
| 179,085.6190 | 252 | 4.1112 | Industrial | M-1 | N | N | - | - | 3.38 | 0.0 | - | - | - | 0.00 | 2,200 | 9,045 | 5% | 452 | | 452 | 0.5 | 1,059 | 1.5 | 0.00 | 1 | 0.00 | 0.00 | 0.00 | 0.5 |
| 184,480.0740 | 271 | 4.2351 | Industrial | M-2 | N | N | - | - | 3.38 | 0.0 | - | - | - | 0.00 | 2,200 | 9,317 | 5% | 466 | | 466 | 0.5 | 1,091 | 1.5 | 0.00 | 2 | 0.00 | 0.00 | 0.00 | 0.5 |
| 200,881.1430 | 244 | 4.6116 | Industrial | M-1 | N | N | - | - | 3.38 | 0.0 | - | - | - | 0.00 | 2,200 | 10,146 | 5% | 507 | | 507 | 0.6 | 1,188 | 1.6 | 0.00 | 2 | 0.00 | 0.00 | 0.00 | 0.6 |
| 203,548.1230 | 243 | 4.6728 | Industrial | M-1 | N | N | - | - | 3.38 | 0.0 | - | - | - | 0.00 | 2,200 | 10,280 | 5% | 514 | | 514 | 0.6 | 1,203 | 1.7 | 0.00 | 2 | 0.00 | 0.00 | 0.00 | 0.6 |
| 204,823.9120 | 245 | 4.7021 | Industrial | M-1 | N | N | - | - | 3.38 | 0.0 | - | - | - | 0.00 | 2,200 | 10,345 | 5% | 517 | | 517 | 0.6 | 1,211 | 1.7 | 0.00 | 2 | 0.00 | 0.00 | 0.00 | 0.6 |
| 207,908.8320 | 231 | 4.7729 | Industrial | M-2 | N | N | - | - | 3.38 | 0.0 | - | - | - | 0.00 | 2,200 | 10,500 | 5% | 525 | | 525 | 0.6 | 1,229 | 1.7 | 0.00 | 2 | 0.00 | 0.00 | 0.00 | 0.6 |
| 211,163.4680 | 254 | 4.8476 | Industrial | M-1 | N | N | - | - | 3.38 | 0.0 | - | - | - | 0.00 | 2,200 | 10,665 | 5% | 533 | | 533 | 0.6 | 1,249 | 1.7 | 0.00 | 2 | 0.00 | 0.00 | 0.00 | 0.6 |
| 215,944.5330 | 277 | 4.9574 | Industrial | M-1 | N | N | - | - | 3.38 | 0.0 | - | - | - | 0.00 | 2,200 | 10,906 | 5% | 545 | | 545 | 0.6 | 1,277 | 1.8 | 0.00 | 2 | 0.00 | 0.00 | 0.00 | 0.6 |
| 216,741.8750 | 270 | 4.9757 | Industrial | M-2 | N | N | - | - | 3.38 | 0.0 | - | - | - | 0.00 | 2,200 | 10,947 | 5% | 547 | | 547 | 0.6 | 1,281 | 1.8 | 0.00 | 2 | 0.00 | 0.00 | 0.00 | 0.6 |
| 223,766.6580 | 234 | 5.1370 | Industrial | M-2 | N | N | - | - | 3.38 | 0.0 | - | - | - | 0.00 | 2,200 | 11,301 | 5% | 565 | | 565 | 0.6 | 1,323 | 1.8 | 0.00 | 2 | 0.00 | 0.00 | 0.00 | 0.6 |
| 313,277.2070 | 233 | 7.1919 | Industrial | M-2 | N | N | - | - | 3.38 | 0.0 | - | - | - | 0.00 | 2,200 | 15,822 | 5% | 791 | | 791 | 0.9 | 1,852 | 2.6 | 0.00 | 3 | 0.00 | 0.00 | 0.00 | 0.9 |
| 329,406.0310 | 232 | 7.5621 | Industrial | M-2 | N | N | - | - | 3.38 | 0.0 | - | - | - | 0.00 | 2,200 | 16,637 | 5% | 832 | | 832 | 0.9 | 1,948 | 2.7 | 0.00 | 3 | 0.00 | 0.00 | 0.00 | 0.9 |
| 339,107.9480 | 275 | 7.7848 | Industrial | M-1 | N | N | - | - | 3.38 | 0.0 | - | - | - | 0.00 | 2,200 | 17,127 | 5% | 856 | | 856 | 1.0 | 2,005 | 2.8 | 0.00 | 3 | 0.00 | 0.00 | 0.00 | 1.0 |
| 374,494.2500 | 228 | 8.5972 | Industrial | M-2 | N | N | - | - | 3.38 | 0.0 | - | - | - | 0.00 | 2,200 | 18,914 | 5% | 946 | | 946 | 1.1 | 2,214 | 3.1 | 0.00 | 3 | 0.00 | 0.00 | 0.00 | 1.1 |
| 399,239.8320 | 55 | 9.1653 | Industrial | SJCV & MCD Fish Rearing Ponds | Y | N | - | - | 3.38 | 0.0 | - | - | - | 0.00 | 2,200 | 20,164 | 5% | 1,008 | 126,027 | 127,036 | 142.3 | 600,000 | 833.3 | 1.20 | 833 | 1.20 | 0.60 | 0.13 | 142.3 |
| 399,934.3740 | 255 | 9.1812 | Industrial | M-2 | N | N | - | - | 3.38 | 0.0 | - | - | - | 0.00 | 2,200 | 20,199 | 5% | 1,010 | | 1,010 | 1.1 | 2,365 | 3.3 | 0.00 | 3 | 0.00 | 0.00 | 0.00 | 1.1 |
| 423,346.0270 | 268 | 9.7187 | Industrial | M-2 | N | N | - | - | 3.38 | 0.0 | - | - | - | 0.00 | 2,200 | 21,381 | 5% | 1,069 | | 1,069 | 1.2 | 2,503 | 3.5 | 0.01 | 3 | 0.01 | 0.00 | 0.00 | 1.2 |
| 435,684.9720 | 267 | 10.0020 | Industrial | M-2 | N | N | - | - | 3.38 | 0.0 | - | - | - | 0.00 | 2,200 | 22,004 | 5% | 1,100 | | 1,100 | 1.2 | 2,576 | 3.6 | 0.01 | 4 | 0.01 | 0.00 | 0.00 | 1.2 |
| 465,320.9660 | 276 | 10.6823 | Industrial | M-1 | N | N | - | - | 3.38 | 0.0 | - | - | - | 0.00 | 2,200 | 23,501 | 5% | 1,175 | | 1,175 | 1.3 | 2,751 | 3.8 | 0.01 | 4 | 0.01 | 0.00 | 0.00 | 1.3 |
| 558,413.5400 | 269 | 12.8194 | Industrial | M-2 | N | N | - | - | 3.38 | 0.0 | - | - | - | 0.00 | 2,200 | 28,203 | 5% | 1,410 | | 1,410 | 1.6 | 3,302 | 4.6 | 0.01 | 5 | 0.01 | 0.00 | 0.00 | 1.6 |
| 617,612.2280 | 253 | 14.1784 | Industrial | M-1 | N | N | - | - | 3.38 | 0.0 | - | - | - | 0.00 | 2,200 | 31,193 | 5% | 1,560 | | 1,560 | 1.7 | 3,652 | 5.1 | 0.01 | 5 | 0.01 | 0.00 | 0.00 | 1.7 |
| 633,927.8840 | 230 | 14.5530 | Industrial | M-2 | N | N | - | - | 3.38 | 0.0 | - | - | - | 0.00 | 2,200 | 32,017 | 5% | 1,601 | | 1,601 | 1.8 | 3,748 | 5.2 | 0.01 | 5 | 0.01 | 0.00 | 0.00 | 1.8 |
| 743,726.4470 | 274 | 17.0736 | Industrial | M-1 | N | N | - | - | 3.38 | 0.0 | - | - | - | 0.00 | 2,200 | 37,562 | 5% | 1,878 | | 1,878 | 2.1 | 4,397 | 6.1 | 0.01 | 6 | 0.01 | 0.00 | 0.00 | 2.1 |
| 807,304.7920 | 222 | 18.5332 | Industrial | Certainteed | Y | N | - | - | 3.38 | 0.0 | - | - | - | 0.00 | 2,200 | 40,773 | 5% | 2,039 | - | 2,039 | 2.3 | 4,773 | 6.6 | 0.01 | 7 | 0.01 | 0.00 | 0.00 | 2.3 |

Attachment B

Table B-1

| | | | | | | Water Meter Information | Irrigation Demand | | | | | | | | WUF-Based Irrigation and Non-Irrigation Demand | | | | | | | | | Total Demand | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Area | Potential User ID | Acres | Category | Name | Existing? | Water Meter Data? | Metered Average Day Demand | Irrigable Area | Unit Irrigation Demand | Irrigation Demand | Average Day Demand | Peak Day Demand | Peak Hour Demand | | WUF | Unadjusted Average Day Demand | $K_{WUF}$ | Adjust Average Day Demand | Additional Demand | Total Average Day Demand | Annual Demand | Peak Day Demand | Peak Hour Demand | | Total Peak Hour Demand | Total Peak Day Demand | Total Average Annual Demand | | |
| (sq. ft.) | | | | | (Y/N) | (Y/N) | (gpd) | (acres) | (AFY/acre) | (AFY) | (gpd) | (gpd) | (gpm) | (mgd) | (gpd/acre) | (gpd) | (%) | (gpd) | (gpd) | (gpd) | (afy) | (gpd) | (gpm) | (mgd) | (gpm) | (mgd) | (mgd) | (mgd) | (afy) |
| 882,367.2530 | 273 | 20.2564 | Industrial | M-1 | N | N | - | - | 3.38 | 0.0 | - | - | - | 0.00 | 2,200 | 44,564 | 5% | 2,228 | | 2,228 | 2.5 | 5,217 | 7.2 | 0.01 | 7 | 0.01 | 0.01 | 0.00 | 2.5 |
| 1,007,422.0200 | 291 | 23.1272 | Industrial | M-1 | N | N | - | - | 3.38 | 0.0 | - | - | - | 0.00 | 2,200 | 50,880 | 5% | 2,544 | | 2,544 | 2.8 | 5,956 | 8.3 | 0.01 | 8 | 0.01 | 0.01 | 0.00 | 2.8 |
| 774,683.4310 | 347 | 17.7843 | Lake | Mallard Lake | Y | N | - | - | - | 0.0 | - | - | - | 0.00 | - | - | 0% | - | 62,533 | 62,533 | 70.0 | 146,413 | 203.4 | 0.29 | 203 | 0.29 | 0.15 | 0.06 | 70.0 |
| 41,250.1012 | 355 | 0.9470 | Median Strip | Westgate Dr | N | N | - | 0.95 | 3.38 | 3.2 | 2,861 | 6,699 | 9 | 0.01 | - | - | 0% | - | | - | - | - | - | - | 9 | 0.01 | 0.01 | 0.00 | 3.2 |
| 61,663.2432 | 353 | 1.4156 | Median Strip | Westgate Dr | N | N | - | 1.42 | 3.38 | 4.8 | 4,277 | 10,014 | 14 | 0.02 | - | - | 0% | - | | - | - | - | - | - | 14 | 0.02 | 0.01 | 0.00 | 4.8 |
| 76,932.9051 | 1 | 1.7661 | Median Strip | Hwy. 99 | Y | Y | 4,609 | 1.77 | 3.38 | 6.0 | 4,609 | 10,791 | 15 | 0.02 | - | - | 0% | - | | - | - | - | - | - | 15 | 0.02 | 0.01 | 0.00 | 5.2 |
| 78,720.4552 | 354 | 1.8072 | Median Strip | Westgate Dr | N | N | - | 1.81 | 3.38 | 6.1 | 5,460 | 12,784 | 18 | 0.03 | - | - | 0% | - | | - | - | - | - | - | 18 | 0.03 | 0.01 | 0.01 | 6.1 |
| 109,748.8030 | 352 | 2.5195 | Median Strip | Century Blvd | N | N | - | 2.52 | 3.38 | 8.5 | 7,612 | 17,822 | 25 | 0.04 | - | - | 0% | - | | - | - | - | - | - | 25 | 0.04 | 0.02 | 0.01 | 8.5 |
| 205,382.5460 | 351 | 4.7149 | Median Strip | Hwy. 99 | Y | Y | 1,650 | 4.71 | 3.38 | 16.0 | 1,650 | 3,863 | 5 | 0.01 | - | - | 0% | - | | - | - | - | - | - | 5 | 0.01 | 0.00 | 0.00 | 1.8 |
| 212,222.6040 | 0 | 4.8720 | Median Strip | Hwy. 99 | Y | Y | 1,077 | 4.87 | 3.38 | 16.5 | 1,077 | 2,522 | 4 | 0.01 | - | - | 0% | - | | - | - | - | - | - | 4 | 0.01 | 0.00 | 0.00 | 1.2 |
| 74,500.3482 | 297 | 1.7103 | Residential | R-LD | N | N | - | - | 3.38 | 0.0 | - | - | - | 0.00 | 6,983 | 11,942 | 0% | - | | - | - | - | - | - | - | - | - | - | - |
| 76,880.2489 | 310 | 1.7649 | Residential | R-2 | N | N | - | - | 3.38 | 0.0 | - | - | - | 0.00 | 6,983 | 12,324 | 0% | - | | - | - | - | - | - | - | - | - | - | - |
| 80,629.0907 | 298 | 1.8510 | Residential | R-LD | N | N | - | - | 3.38 | 0.0 | - | - | - | 0.00 | 6,983 | 12,925 | 0% | - | | - | - | - | - | - | - | - | - | - | - |
| 80,924.7396 | 343 | 1.8578 | Residential | HDR | N | N | - | - | 3.38 | 0.0 | - | - | - | 0.00 | 6,983 | 12,972 | 0% | - | | - | - | - | - | - | - | - | - | - | - |
| 96,205.2372 | 309 | 2.2086 | Residential | R-2 | N | N | - | - | 3.38 | 0.0 | - | - | - | 0.00 | 6,983 | 15,421 | 0% | - | | - | - | - | - | - | - | - | - | - | - |
| 164,030.7330 | 311 | 3.7656 | Residential | R-2 | N | N | - | - | 3.38 | 0.0 | - | - | - | 0.00 | 6,983 | 26,293 | 0% | - | | - | - | - | - | - | - | - | - | - | - |
| 220,684.3120 | 332 | 5.0662 | Residential | LDR | N | N | - | - | 3.38 | 0.0 | - | - | - | 0.00 | 6,983 | 35,375 | 0% | - | | - | - | - | - | - | - | - | - | - | - |
| 229,698.7760 | 312 | 5.2732 | Residential | R-2 | N | N | - | - | 3.38 | 0.0 | - | - | - | 0.00 | 6,983 | 36,820 | 0% | - | | - | - | - | - | - | - | - | - | - | - |
| 277,495.3060 | 225 | 6.3704 | Residential | R-MD | N | N | - | - | 3.38 | 0.0 | - | - | - | 0.00 | 6,983 | 44,481 | 0% | - | | - | - | - | - | - | - | - | - | - | - |
| 294,440.4570 | 334 | 6.7594 | Residential | MDR | N | N | - | - | 3.38 | 0.0 | - | - | - | 0.00 | 6,983 | 47,198 | 0% | - | | - | - | - | - | - | - | - | - | - | - |
| 343,913.5330 | 329 | 7.8952 | Residential | LDR | N | N | - | - | 3.38 | 0.0 | - | - | - | 0.00 | 6,983 | 55,128 | 0% | - | | - | - | - | - | - | - | - | - | - | - |
| 366,186.8600 | 325 | 8.4065 | Residential | MDR | N | N | - | - | 3.38 | 0.0 | - | - | - | 0.00 | 6,983 | 58,698 | 0% | - | | - | - | - | - | - | - | - | - | - | - |
| 370,293.1670 | 313 | 8.5008 | Residential | R-1 | N | N | - | - | 3.38 | 0.0 | - | - | - | 0.00 | 6,983 | 59,357 | 0% | - | | - | - | - | - | - | - | - | - | - | - |
| 374,866.4390 | 327 | 8.6057 | Residential | HDR | N | N | - | - | 3.38 | 0.0 | - | - | - | 0.00 | 6,983 | 60,090 | 0% | - | | - | - | - | - | - | - | - | - | - | - |
| 397,800.5220 | 314 | 9.1322 | Residential | R-1 (plus R-C-P and C-S) | N | N | - | - | 3.38 | 0.0 | - | - | - | 0.00 | 6,983 | 63,766 | 0% | - | | - | - | - | - | - | - | - | - | - | - |
| 420,121.4290 | 338 | 9.6447 | Residential | HDR | N | N | - | - | 3.38 | 0.0 | - | - | - | 0.00 | 6,983 | 67,344 | 0% | - | | - | - | - | - | - | - | - | - | - | - |
| 442,310.3970 | 324 | 10.1540 | Residential | HDR | N | N | - | - | 3.38 | 0.0 | - | - | - | 0.00 | 6,983 | 70,901 | 0% | - | | - | - | - | - | - | - | - | - | - | - |
| 479,619.9630 | 328 | 11.0106 | Residential | MDR | N | N | - | - | 3.38 | 0.0 | - | - | - | 0.00 | 6,983 | 76,881 | 0% | - | | - | - | - | - | - | - | - | - | - | - |
| 517,248.8900 | 331 | 11.8744 | Residential | LDR | N | N | - | - | 3.38 | 0.0 | - | - | - | 0.00 | 6,983 | 82,913 | 0% | - | | - | - | - | - | - | - | - | - | - | - |
| 596,166.2390 | 344 | 13.6861 | Residential | HDR | N | N | - | - | 3.38 | 0.0 | - | - | - | 0.00 | 6,983 | 95,563 | 0% | - | | - | - | - | - | - | - | - | - | - | - |
| 639,710.0730 | 333 | 14.6857 | Residential | LDR | N | N | - | - | 3.38 | 0.0 | - | - | - | 0.00 | 6,983 | 102,543 | 0% | - | | - | - | - | - | - | - | - | - | - | - |
| 640,199.5600 | 341 | 14.6970 | Residential | MDR | N | N | - | - | 3.38 | 0.0 | - | - | - | 0.00 | 6,983 | 102,622 | 0% | - | | - | - | - | - | - | - | - | - | - | - |
| 648,617.7420 | 342 | 14.8902 | Residential | MDR | N | N | - | - | 3.38 | 0.0 | - | - | - | 0.00 | 6,983 | 103,971 | 0% | - | | - | - | - | - | - | - | - | - | - | - |
| 750,563.3590 | 336 | 17.2306 | Residential | LDR | N | N | - | - | 3.38 | 0.0 | - | - | - | 0.00 | 6,983 | 120,312 | 0% | - | | - | - | - | - | - | - | - | - | - | - |
| 811,034.7220 | 335 | 18.6188 | Residential | MDR | N | N | - | - | 3.38 | 0.0 | - | - | - | 0.00 | 6,983 | 130,006 | 0% | - | | - | - | - | - | - | - | - | - | - | - |
| 951,590.4930 | 326 | 21.8455 | Residential | MDR | N | N | - | - | 3.38 | 0.0 | - | - | - | 0.00 | 6,983 | 152,536 | 0% | - | | - | - | - | - | - | - | - | - | - | - |
| 1,021,676.1700 | 337 | 23.4545 | Residential | LDR | N | N | - | - | 3.38 | 0.0 | - | - | - | 0.00 | 6,983 | 163,771 | 0% | - | | - | - | - | - | - | - | - | - | - | - |
| 1,106,731.5500 | 345 | 25.4071 | Residential | LDR | N | N | - | - | 3.38 | 0.0 | - | - | - | 0.00 | 6,983 | 177,405 | 0% | - | | - | - | - | - | - | - | - | - | - | - |
| 1,254,728.2600 | 323 | 28.8046 | Residential | LDR | N | N | - | - | 3.38 | 0.0 | - | - | - | 0.00 | 6,983 | 201,128 | 0% | - | | - | - | - | - | - | - | - | - | - | - |
| 1,757,410.3400 | 340 | 40.3446 | Residential | MDR | N | N | - | - | 3.38 | 0.0 | - | - | - | 0.00 | 6,983 | 281,706 | 0% | - | | - | - | - | - | - | - | - | - | - | - |
| 1,907,334.1500 | 322 | 43.7864 | Residential | LDR | N | N | - | - | 3.38 | 0.0 | - | - | - | 0.00 | 6,983 | 305,738 | 0% | - | | - | - | - | - | - | - | - | - | - | - |
| 3,066,679.8500 | 330 | 70.4013 | Residential | LDR | N | N | - | - | 3.38 | 0.0 | - | - | - | 0.00 | 6,983 | 491,577 | 0% | - | | - | - | - | - | - | - | - | - | - | - |
| 71,944.7415 | 9 | 1.6516 | School | St. Anne's School (private) | Y | N | - | 0.66 | 3.38 | 2.2 | 1,996 | 4,673 | 10 | 0.01 | - | - | 0% | - | | - | - | - | - | - | 10 | 0.01 | 0.00 | 0.00 | 2.2 |
| 225,688.3490 | 8 | 5.1811 | School | Heritage Primary Elementary School | Y | Y | 6,072 | 2.07 | 3.38 | 7.0 | 6,072 | 14,217 | 30 | 0.04 | - | - | 0% | - | | - | - | - | - | - | 30 | 0.04 | 0.01 | 0.01 | 6.8 |
| 307,466.7010 | 15 | 7.0585 | School | Needham Elementary School | Y | Y | 7,493 | 2.82 | 3.38 | 9.6 | 7,493 | 17,543 | 37 | 0.05 | - | - | 0% | - | | - | - | - | - | - | 37 | 0.05 | 0.02 | 0.01 | 8.4 |
| 342,777.1870 | 18 | 7.8691 | School | Vinewood Elementary School | Y | Y | 10,980 | 3.15 | 3.38 | 10.7 | 10,980 | 25,708 | 54 | 0.08 | - | - | 0% | - | | - | - | - | - | - | 54 | 0.08 | 0.03 | 0.01 | 12.3 |
| 387,454.8890 | 17 | 8.8947 | School | Erma B. Reese Elementary School | Y | Y | 8,300 | 3.56 | 3.38 | 12.0 | 8,300 | 19,434 | 40 | 0.06 | - | - | 0% | - | | - | - | - | - | - | 40 | 0.06 | 0.02 | 0.01 | 9.3 |
| 415,510.6610 | 7 | 9.5388 | School | Lakewood Elementary School | Y | Y | 9,950 | 3.82 | 3.38 | 12.9 | 9,950 | 23,297 | 49 | 0.07 | - | - | 0% | - | | - | - | - | - | - | 49 | 0.07 | 0.02 | 0.01 | 11.1 |
| 448,219.7400 | 10 | 10.2897 | School | Lawrence Elementary School | Y | Y | 2,334 | 4.12 | 3.38 | 13.9 | 2,334 | 5,464 | 11 | 0.02 | - | - | 0% | - | | - | - | - | - | - | 11 | 0.02 | 0.01 | 0.00 | 2.6 |
| 487,322.0510 | 53 | 11.1874 | School | Westside | N | N | - | 4.47 | 3.38 | 15.1 | 13,520 | 31,655 | 66 | 0.09 | - | - | 0% | - | | - | - | - | - | - | 66 | 0.09 | 0.03 | 0.01 | 15.1 |
| 501,136.3010 | 13 | 11.5045 | School | George Washington Elementary School | Y | Y | 13,339 | 4.60 | 3.38 | 15.6 | 13,339 | 31,231 | 65 | 0.09 | - | - | 0% | - | | - | - | - | - | - | 65 | 0.09 | 0.03 | 0.01 | 14.9 |
| 503,134.8020 | 39 | 11.5504 | School | Lois E. Borchardt Elementary School | Y | N | - | 4.62 | 3.38 | 15.6 | 13,959 | 32,682 | 68 | 0.10 | - | - | 0% | - | | - | - | - | - | - | 68 | 0.10 | 0.03 | 0.01 | 15.6 |
| 511,716.4990 | 16 | 11.7474 | School | Woodbridge Elementary School | Y | Y | 2,489 | 4.70 | 3.38 | 15.9 | 2,489 | 5,827 | 12 | 0.02 | - | - | 0% | - | | - | - | - | - | - | 12 | 0.02 | 0.01 | 0.00 | 2.8 |
| 553,957.5460 | 356 | 12.7171 | School | Larson School | Y | N | | 5.09 | 3.38 | 17.2 | 15,369 | 35,983 | 75 | 0.11 | - | - | 0% | - | | - | - | - | - | - | 75 | 0.11 | 0.04 | 0.02 | 17.2 |
| 562,434.9140 | 51 | 12.9117 | School | Reynolds Ranch | N | N | - | 5.16 | 3.38 | 17.5 | 15,604 | 36,534 | 76 | 0.11 | - | - | 0% | - | | - | - | - | - | - | 76 | 0.11 | 0.04 | 0.02 | 17.5 |
| 567,737.0760 | 5 | 13.0334 | School | Millswood School | Y | Y | 13,861 | 5.21 | 3.38 | 17.6 | 13,861 | 32,454 | 68 | 0.10 | - | - | 0% | - | | - | - | - | - | - | 68 | 0.10 | 0.03 | 0.01 | 15.5 |
| 571,736.6400 | 52 | 13.1253 | School | Southwest Gateway | N | N | - | 5.25 | 3.38 | 17.8 | 15,862 | 37,138 | 77 | 0.11 | - | - | 0% | - | | - | - | - | - | - | 77 | 0.11 | 0.04 | 0.02 | 17.8 |
| 849,060.4120 | 11 | 19.4917 | School | Lodi Middle School | Y | Y | 30,054 | 7.80 | 3.38 | 26.4 | 30,054 | 70,368 | 147 | 0.21 | - | - | 0% | - | | - | - | - | - | - | 147 | 0.21 | 0.07 | 0.03 | 33.7 |
| 1,143,206.0600 | 348 | 26.2444 | School | Jim Elliot School | Y | N | - | 10.50 | 3.38 | 35.5 | 31,716 | 74,259 | 155 | 0.22 | - | - | 0% | - | | - | - | - | - | - | 155 | 0.22 | 0.07 | 0.03 | 35.5 |
| 1,445,331.6400 | 350 | 33.1802 | School | Lodi Academy | Y | N | - | 13.27 | 3.38 | 44.9 | 40,098 | 93,884 | 196 | 0.28 | - | - | 0% | - | | - | - | - | - | - | 196 | 0.28 | 0.09 | 0.04 | 44.9 |
| 1,924,061.0000 | 12 | 44.1704 | School | Lodi High School | Y | Y | 8,651 | 17.67 | 3.38 | 59.8 | 8,651 | 20,256 | 42 | 0.06 | - | - | 0% | - | | - | - | - | - | - | 42 | 0.06 | 0.02 | 0.01 | 9.7 |
| 2,058,444.4400 | 14 | 47.2554 | School | Tokay High School | Y | Y | 67,063 | 18.90 | 3.38 | 64.0 | 67,063 | 157,018 | 327 | 0.47 | - | - | 0% | - | | - | - | - | - | - | 327 | 0.47 | 0.16 | 0.07 | 75.1 |
| | | **5,887 acres** | | | | | | **4,674 acres** | | **10,843 afy** | **9,426,300 gpd** | **33,652,174 gpd** | **47,342 gpm** | **68.17 mgd** | | **4,277,951 gpd** | | **49,912 gpd** | **2,388,561 gpd** | **2,438,473 gpd** | **2,731 afy** | **3,359,453 gpd** | **2,930 gpm** | **4.22 mgd** | **50,271 gpm** | **72.39 mgd** | **37.01 mgd** | **11.09 mgd** | **12,426 afy** |

# Attachment C: Supplemental Demand Estimate Methodology Information

Attachment C

Table C-1

# Water Meter Data

| Category | Acct# | Meter # | Annual Water Use (gal) 2006 | 2005 | 2004 | 2003 | 2002 |
|---|---|---|---|---|---|---|---|
| **Existing Parks** | | | | | | | |
| Blakely Park | 3987 | 12085195 | 6,919,000 | 6,821,760 | 6,892,820 | 5,572,600 | 7,450,080 |
| Candy Cane Park | 3900 | 3211812 | 445,060 | 552,772 | 404,668 | 262,548 | 410,652 |
| Emerson Park | 3902 | 3167720 | 2,398,836 | 2,502,060 | 2,484,108 | 2,157,232 | 2,390,608 |
| English Oaks Common | 3947 | 2163311 | 4,128,960 | 2,962,080 | 3,594,140 | 3,425,840 | 3,478,200 |
| Hale Park | 3926 | 10763073 | 2,241,008 | 2,153,492 | 2,256,716 | 1,906,652 | 2,671,108 |
| Katzakian Park | 39856 | 12951612 | 6,518,820 | 5,647,400 | 6,152,300 | 5,684,800 | 8,284,100 |
| Lawrence Park | 3922 | 3239416 | 160,820 | 131,648 | 155,584 | 116,688 | 92,752 |
| | 4022 | 1219452 | 4,108,614 | 4,302,870 | 5,194,112 | 4,141,227 | 5,143,772 |
| | | Total | 4,269,434 | 4,434,518 | 5,349,696 | 4,257,915 | 5,236,524 |
| Legion Park | 3912 | 2514264 | 3,491,664 | 3,556,740 | 4,051,168 | 3,559,732 | 3,654,728 |
| Van Buskirk Park | 3962 | 3213267 | 1,238,688 | 1,608,200 | 1,345,652 | 1,187,824 | 1,268,608 |
| Vinewood Park | 4020 | 1154106 | 12,774,344 | 12,721,236 | 10,121,936 | 11,674,784 | 11,425,700 |
| Chapman Field | 3920 | 1184484 | 1,653,080 | 1,758,690 | 2,153,492 | 1,586,508 | 2,205,852 |
| Grape Bowl | 3848 | 38266084 | 11,669 | 16,531 | 23,188 | 48,246 | 10,996 |
| | 3978 | 39016510 | 718,454 | 897,002 | 1,462,938 | 926,398 | 727,654 |
| | | Total | 730,123 | 913,533 | 1,486,126 | 974,644 | 738,650 |
| Peterson Park | 3874 | 7567862 | 94,996 | 118,184 | 71,808 | 112,948 | 85,272 |
| | 3875 | 7471935 | 22,974,820 | 21,901,440 | 25,888,280 | 22,791,560 | 25,776,080 |
| | | Total | 23,069,816 | 22,019,624 | 25,960,088 | 22,904,508 | 25,861,352 |
| Pixley Park | 4015 | 14194758 | 3,740 | 170 | 24,684 | 3,516 | 10,472 |
| Zupo Field | 4022 | 1184994 | 8,158,877 | 10,070,705 | 10,465,216 | 6,979,573 | 7,476,260 |
| Lodi Lake Park | 4009 | 7475583 | 5,912,940 | 5,142,500 | 5,830,660 | 5,565,120 | 7,293,000 |
| | 24860 | 9551741 | 2,756,380 | 2,483,360 | 3,036,880 | 2,905,980 | 2,950,860 |
| | 24860 | 9603238 | 3,119,160 | 2,999,480 | 3,833,500 | 3,878,380 | 3,960,660 |
| | 51427 | 53545218 | 1,496 | 2,244 | 2,444 | 5,229 | |
| | | Total | 11,789,976 | 10,627,584 | 12,703,484 | 12,354,709 | 14,204,520 |
| **Existing Lodi Unified School District Schools** | | | | | | | |
| Beckman Elementary School | 11942 | 14123352 | 6,533,780 | 6,331,072 | 8,591,528 | 7,898,880 | 2,695,044 |
| Ellerth Larson Elementary School | 61686 | 49001173 | 707,630 | 282,071 | | | |
| | 61686 | 56462084 | 27,565,206 | 8,392,859 | | | |
| | | Total | 28,272,836 | 8,674,930 | 0 | 0 | 0 |
| Heritage Primary Elementary School | 11927 | 14118618 | 3,193,960 | 3,141,600 | 4,282,300 | 3,443,792 | 4,407,964 |
| Joe Serna Jr Charter School | 49983 | 2832336 | 347,072 | 0 | 1,403,996 | 1,115,268 | 1,557,336 |
| | 49983 | 13321197 | 383,739 | 844,492 | 340,340 | 1,835,592 | 74,800 |
| | 50631 | 7253153 | 11,661 | 55,569 | 216,920 | 108,460 | 85,272 |
| | | Total | 742,472 | 900,061 | 1,961,256 | 3,059,320 | 1,717,408 |
| Lakewood Elementary School | 11928 | 1117985 | 4,437,734 | 3,974,124 | 4,488,748 | 5,000,380 | 5,510,725 |
| | 11928 | 2477444 | 1,425,464 | 1,293,292 | 1,206,524 | 1,415,216 | 1,512,456 |
| | | Total | 5,863,198 | 5,267,416 | 5,695,272 | 6,415,596 | 7,023,181 |
| Lawrence Elementary School | 11919 | 58500582 | 5,241,341 | 43,691 | 50,408 | 59,930 | 58,307 |
| | 11919 | 2614775 | 411,684 | 53,856 | 83,776 | 486,200 | 608,872 |
| | | Total | 5,653,025 | 97,547 | 134,184 | 546,130 | 667,179 |
| Needham School | 11922 | 2538880 | 353,804 | 318,648 | 590,172 | 484,704 | 379,236 |
| | 11923 | 1150865 | 3,243,178 | 2,877,855 | 3,369,441 | 3,493,160 | 3,029,250 |
| | 11938 | 33447251 | 814,123 | 755,031 | 1,048,696 | 836,339 | 899,246 |
| | 11940 | 39726644 | 70,005 | 60,334 | 60,102 | 54,350 | 52,293 |
| | | Total | 4,481,110 | 4,011,868 | 5,068,411 | 4,868,553 | 4,360,025 |
| Nichols Elementary School | 11925 | 1144059 | 866,468 | 907,735 | 1,088,714 | 1,218,118 | 1,330,542 |
| | 11925 | 10632568 | 1,733,213 | 14,212 | 18,700 | 62,832 | 68,816 |
| | 11925 | 26566782 | 10,674,648 | 8,765,191 | 10,165,320 | 7,962,430 | 8,460,927 |
| | | Total | 13,274,329 | 9,687,138 | 11,272,734 | 9,243,380 | 9,860,285 |

Attachment C

Table C-1

| Category | Acct# | Meter # | Annual Water Use (gal) 2006 | 2005 | 2004 | 2003 | 2002 |
|---|---|---|---|---|---|---|---|
| Reese Elementary School | 11926 | 1227875 | 872,617 | 942,854 | 928,941 | 922,209 | 1,100,607 |
| | 11933 | 1117984 | 3,659,216 | 3,794,604 | 4,574,342 | 4,189,548 | 4,262,104 |
| | | Total | 4,531,833 | 4,737,458 | 5,503,283 | 5,111,757 | 5,362,711 |
| Vinewood Elementary School | 11943 | 1661524 | 2,567,338 | 2,285,888 | 2,698,036 | 2,522,256 | 2,625,480 |
| | 11943 | 8590732 | 3,374,520 | 2,803,504 | 4,623,388 | 4,938,296 | 4,958,514 |
| | | Total | 5,941,858 | 5,089,392 | 7,321,424 | 7,460,552 | 7,583,994 |
| Washington Elementary School | 11932 | 1115741 | 4,904,524 | 3,450,449 | 5,285,966 | 5,372,510 | 5,336,830 |
| | 11932 | 31226386 | 3,967,078 | 3,033,888 | 3,465,484 | 2,762,364 | 2,992,748 |
| | | Total | 8,871,602 | 6,484,337 | 8,751,450 | 8,134,874 | 8,329,578 |
| Woodbridge Elementary School | 11931 | 8717866 | 688,160 | 706,860 | 867,680 | 3,164,040 | 2,143,020 |
| Lodi Middle School | 11929 | 1245309 | 3,505,128 | 3,539,536 | 3,924,756 | 3,006,212 | 3,366,748 |
| | 11945 | 4938911 | 13,213,420 | 12,592,124 | 17,782,952 | 14,114,760 | 16,369,980 |
| | | Total | 16,718,548 | 16,131,660 | 21,707,708 | 17,120,972 | 19,736,728 |
| Millswood Middle School | 51343 | 14098218 | 8,019,308 | 943,527 | | | |
| | 51343 | 49001166 | 561,000 | 7,340,520 | 128,447 | 0 | 0 |
| | | Total | 8,580,308 | 8,284,047 | 128,447 | 0 | 0 |
| Liberty High School | 11947 | 29717823 | 549,885 | 609,029 | 797,817 | 391,952 | 505,872 |
| Lodi High School | 11934 | 41016394 | 132,351 | 106,388 | 165,555 | 164,283 | 250,228 |
| | 25596 | 1260298 | 6,006,829 | 3,988,336 | 4,689,212 | 3,513,356 | 4,443,120 |
| | | Total | 6,689,065 | 4,703,753 | 5,652,584 | 4,069,591 | 5,199,220 |
| Tokay High School | 25564 | 7476732 | 21,239,340 | 18,142,740 | 22,312,840 | 20,431,620 | 21,123,520 |
| | 25564 | 9304555 | 23,453,173 | 17,791,180 | 19,937,940 | 19,885,580 | 19,664,920 |
| | | Total | 44,692,513 | 35,933,920 | 42,250,780 | 40,317,200 | 40,788,440 |
| **Other Customers** | | | | | | | |
| Caltrans medians and interchanges | 3068 | 41040669 | 439,076 | 457,926 | 399,357 | 376,842 | 292,842 |
| | 33382 | 8713428 | 3,487,924 | 3,241,832 | 1,681,504 | 0 | 0 |
| | 33383 | 6921706 | 38,896 | 152,592 | 9,724 | 505,648 | 2,303,840 |

## Irrigation Demand: Turfgrass

| | A | B | C | D | E | F | G | H | I | J | M | K | L |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Month | Turfgrass Coefficient [a], $K_c$ | $ET_o$ [b] (in) | Average Precipitation [c] (in) | Percent Infiltrate [d] | Leaching Rate Factor [e] | Irrigation Efficiency [f] | Irrigation Demand [g] (in) | Percent of Annual Demand [h] | Monthly Peaking Factor [i] | Days/Month | Unit Area (acres) | Monthly Irrigation Demand [j] (af/acre-month) | Daily Average Flow [l] (mgd) |
| 1 | January | 0.8 | 0.95 | 1.93 | 75% | 1.1 | 80% | 0.0 | 0% | 0.00 | 31 | 1 | 0.00 | 0.000 |
| 2 | February | 0.8 | 1.66 | 1.81 | 75% | 1.1 | 80% | 0.0 | 0% | 0.00 | 28 | 1 | 0.00 | 0.000 |
| 3 | March | 0.8 | 3.18 | 2.18 | 75% | 1.1 | 80% | 1.2 | 3% | 0.37 | 31 | 1 | 0.10 | 0.001 |
| 4 | April | 0.8 | 4.19 | 1.60 | 75% | 1.1 | 80% | 3.0 | 7% | 0.87 | 30 | 1 | 0.25 | 0.003 |
| 5 | May | 0.8 | 6.23 | 0.47 | 75% | 1.1 | 80% | 6.4 | 16% | 1.88 | 31 | 1 | 0.53 | 0.006 |
| 6 | June | 0.8 | 6.74 | 0.11 | 75% | 1.1 | 80% | 7.3 | 18% | 2.16 | 30 | 1 | 0.61 | 0.007 |
| 7 | July | 0.8 | 7.20 | 0.00 | 75% | 1.1 | 80% | 7.9 | 20% | **2.34** | 31 | 1 | 0.66 | 0.007 |
| 8 | August | 0.8 | 6.31 | 0.09 | 75% | 1.1 | 80% | 6.8 | 17% | 2.02 | 31 | 1 | 0.57 | 0.006 |
| 9 | September | 0.8 | 4.74 | 0.05 | 75% | 1.1 | 80% | 5.2 | 13% | 1.52 | 30 | 1 | 0.43 | 0.005 |
| 10 | October | 0.8 | 3.06 | 0.64 | 75% | 1.1 | 80% | 2.7 | 7% | 0.80 | 31 | 1 | 0.23 | 0.002 |
| 11 | November | 0.8 | 1.36 | 1.35 | 75% | 1.1 | 80% | 0.1 | 0% | 0.03 | 30 | 1 | 0.01 | 0.000 |
| 12 | December | 0.8 | 0.79 | 3.46 | 75% | 1.1 | 80% | 0.0 | 0% | 0.00 | 31 | 1 | 0.00 | 0.000 |
| 13 | **Annual Total** | | **46.40** | **13.68** | | | | **40.6** | **100%** | | **365** | | **3.38 afy/acre** | **0.036** |
| 14 | **Average** | | **3.87** | **1.14** | | | | **3.38** | | | | | **0.28** | **0.003** |

Footnotes:

a The crop coefficient is assumed to be a year-round cool season species of turfgrass (OWUE source, conversation w/ OWEU staff).
b From CIMIS Station #166 (Lodi West), Sept 2000 to Present
c From CIMIS Station #166 (Lodi West), Sept 2000 to Present
d Assumed to be 75 percent infiltration rate into the vegetation root zone
e Represents a 10 percent leaching rate through the vegetation root zone
f Assumes efficiency of 80 percent (i.e., 20 percent of applied irrigation water is lost to evaporation)
g Irrigation demand calculated using Methodology A;equals {[(A*B)-(C*D)]*E}/F
h equals G/G13
i equals G/G14
j equals (M/12)/G
l equals (K/J)*(325,851.4/1,000,000)

## Irrigation Demand: Misc. Field Crops

| | A | B | C | D | E | F | G | H | I | J | K | L | M | N | O | P |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Month | 1997 Field and Row Crop Coefficient [a], $K_c$ | 1997 $ET_o$ [b] (in) | 1997 $ET_c$ [b] (in) | 1997 Precipitation [b] (in) | $ET_o$ [c] (in) | Average Precipitation [d] (in) | Percent Infiltrate [e] | Leaching Rate Factor [f] | Irrigation Efficiency [g] | Irrigation Demand [h] (in/acre) | Percent of Annual Demand | Monthly Peaking Factor | Days/Month | Unit Area (acres) | Monthly Irrigation Demand (af/acre-month) | Daily Average Flow (mgd) |
| 1 | January | 1.08 | 0.73 | 0.79 | 6.81 | 0.95 | 1.93 | 75% | 1.1 | 80% | 0.00 | 0% | 0.00 | 31 | 1 | 0.00 | 0.000 |
| 2 | February | 0.39 | 2.12 | 0.83 | 0.27 | 1.66 | 1.81 | 75% | 1.1 | 80% | 0.00 | 0% | 0.00 | 28 | 1 | 0.00 | 0.000 |
| 3 | March | 0.49 | 4.01 | 1.98 | 1.34 | 3.18 | 2.18 | 75% | 1.1 | 80% | 0.00 | 0% | 0.00 | 31 | 1 | 0.00 | 0.000 |
| 4 | April | 0.23 | 5.56 | 1.27 | 0.22 | 4.19 | 1.60 | 75% | 1.1 | 80% | 0.00 | 0% | 0.00 | 30 | 1 | 0.00 | 0.000 |
| 5 | May | 0.33 | 7.32 | 2.41 | 0.21 | 6.23 | 0.47 | 75% | 1.1 | 80% | 2.34 | 10% | 1.24 | 31 | 1 | 0.19 | 0.002 |
| 6 | June | 0.86 | 7.58 | 6.54 | 0.20 | 6.74 | 0.11 | 75% | 1.1 | 80% | 7.88 | 35% | 4.18 | 30 | 1 | 0.66 | 0.007 |
| 7 | July | 0.89 | 7.98 | 7.07 | 0.13 | 7.20 | 0.00 | 75% | 1.1 | 80% | 8.78 | 39% | **4.65** | 31 | 1 | 0.73 | 0.008 |
| 8 | August | 0.42 | 6.76 | 2.84 | 0.34 | 6.31 | 0.09 | 75% | 1.1 | 80% | 3.56 | 16% | 1.89 | 31 | 1 | 0.30 | 0.003 |
| 9 | September | 0.01 | 5.39 | 0.07 | 0.07 | 4.74 | 0.05 | 75% | 1.1 | 80% | 0.03 | 0% | 0.02 | 30 | 1 | 0.00 | 0.000 |
| 10 | October | 0.17 | 3.47 | 0.58 | 0.64 | 3.06 | 0.64 | 75% | 1.1 | 80% | 0.05 | 0% | 0.03 | 31 | 1 | 0.00 | 0.000 |
| 11 | November | 0.43 | 1.05 | 0.45 | 4.15 | 1.36 | 1.35 | 75% | 1.1 | 80% | 0.00 | 0% | 0.00 | 30 | 1 | 0.00 | 0.000 |
| 12 | December | 0.89 | 0.99 | 0.88 | 2.12 | 0.79 | 3.46 | 75% | 1.1 | 80% | 0.00 | 0% | 0.00 | 31 | 1 | 0.00 | 0.000 |
| 13 | **Annual Total** | | **52.96** | | | | **13.68** | | | | **22.6** | **100%** | | **365** | | **1.89 afy/acre** | **0.020** |
| 14 | **Average** | | **4.41** | | | | **1.14** | | | | **1.9** | | | | | **0.16** | **0.002** |

Footnotes:

a Equals C/B
b Source: ITRC
c From CIMIS Station #166 (Lodi West), Sept 2000 to Present
d From CIMIS Station #166 (Lodi West), Sept 2000 to Present
e Assumed to be 75 percent infiltration rate into the vegetation root zone
f Represents a 10 percent leaching rate through the vegetation root zone
g Assumes efficiency of 80 percent (i.e., 20 percent of applied irrigation water is lost to evaporation)
h Irrigation demand calculated using Methodology A;equals {[(A*E)-(F*G)]*H}/I
i equals J/J13
j equals J/J14
k equals (N/12)/J
l equals (O/M)*(325,851.4/1,000,000)

## Irrigation Demand: Vine Crops

| | A | B | C | D | E | F | G | H | I | J | K | L | M | N | O | P |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Month | 1997 Vine Crop Coefficient [a], $K_c$ | 1997 $ET_o$ [b] (in) | 1997 $ET_c$ [b] (in) | 1997 Precipitation [b] (in) | $ET_o$ [c] (in) | Average Precipitation [d] (in) | Percent Infiltrate [e] | Leaching Rate Factor [f] | Irrigation Efficiency [g] | Irrigation Demand [h] (in/acre) | Percent of Annual Demand | Monthly Peaking Factor | Days/Month | Unit Area (acres) | Monthly Irrigation Demand (af/acre-month) | Daily Average Flow (mgd) |
| 1 | January | 1.07 | 0.73 | 0.78 | 6.81 | 0.95 | 1.93 | 75% | 1.1 | 90% | 0.00 | 0% | 0.00 | 31 | 1 | 0.00 | 0.000 |
| 2 | February | 0.62 | 2.12 | 1.32 | 0.27 | 1.66 | 1.81 | 75% | 1.1 | 90% | 0.00 | 0% | 0.00 | 28 | 1 | 0.00 | 0.000 |
| 3 | March | 0.51 | 4.01 | 2.04 | 1.34 | 3.18 | 2.18 | 75% | 1.1 | 90% | 0.00 | 0% | 0.00 | 31 | 1 | 0.00 | 0.000 |
| 4 | April | 0.35 | 5.56 | 1.96 | 0.22 | 4.19 | 1.60 | 75% | 1.1 | 90% | 0.33 | 1% | 0.15 | 30 | 1 | 0.03 | 0.000 |
| 5 | May | 0.55 | 7.32 | 4.02 | 0.21 | 6.23 | 0.47 | 75% | 1.1 | 90% | 3.75 | 9% | 1.68 | 31 | 1 | 0.31 | 0.003 |
| 6 | June | 0.78 | 7.58 | 5.92 | 0.20 | 6.74 | 0.11 | 75% | 1.1 | 90% | 6.33 | 16% | 2.84 | 30 | 1 | 0.53 | 0.006 |
| 7 | July | 0.78 | 7.98 | 6.24 | 0.13 | 7.20 | 0.00 | 75% | 1.1 | 90% | 6.88 | 17% | **3.09** | 31 | 1 | 0.57 | 0.006 |
| 8 | August | 0.74 | 6.76 | 5.03 | 0.34 | 6.31 | 0.09 | 75% | 1.1 | 90% | 5.65 | 14% | 2.54 | 31 | 1 | 0.47 | 0.005 |
| 9 | September | 0.53 | 5.39 | 2.87 | 0.07 | 4.74 | 0.05 | 75% | 1.1 | 90% | 3.03 | 7% | 1.36 | 30 | 1 | 0.25 | 0.003 |
| 10 | October | 0.36 | 3.47 | 1.26 | 0.64 | 3.06 | 0.64 | 75% | 1.1 | 90% | 0.77 | 2% | 0.35 | 31 | 1 | 0.06 | 0.001 |
| 11 | November | 0.50 | 1.05 | 0.53 | 4.15 | 1.36 | 1.35 | 75% | 1.1 | 90% | 0.00 | 0% | 0.00 | 30 | 1 | 0.00 | 0.000 |
| 12 | December | 0.97 | 0.99 | 0.97 | 2.12 | 0.79 | 3.46 | 75% | 1.1 | 90% | 0.00 | 0% | 0.00 | 31 | 1 | 0.00 | 0.000 |
| 13 | **Annual Total** | | **52.96** | | | | **13.68** | | | | **26.7** | **66%** | | **365** | | **2.23 afy/acre** | **0.024** |
| 14 | **Average** | | **4.41** | | | | **1.14** | | | | **2.2** | | | | | **0.19** | **0.002** |

Footnotes:

a Equals C/B
b Source: ITRC
c From CIMIS Station #166 (Lodi West), Sept 2000 to Present
d From CIMIS Station #166 (Lodi West), Sept 2000 to Present
e Assumed to be 75 percent infiltration rate into the vegetation root zone
f Represents a 10 percent leaching rate through the vegetation root zone
g Assumes efficiency of 80 percent (i.e., 20 percent of applied irrigation water is lost to evaporation)
h Irrigation demand calculated using Methodology A;equals {[(A*E)-(F*G)]*H}/I
i equals J/J13
j equals J/J14
k equals (N/12)/J
l equals (O/M)*(325,851.4/1,000,000)

## Irrigation Demand: Deciduous Orchards

| | A | B | C | D | E | F | G | H | I | J | K | L | M | N | O | P |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Month | 1997 Deciduous Orchard Crop Coefficient [a], $K_c$ | 1997 $ET_o$ [b] (in) | 1997 $ET_c$ [b] (in) | 1997 Precipitation [b] (in) | $ET_o$ [c] (in) | Average Precipitation [d] (in) | Percent Infiltrate [e] | Leaching Rate Factor [f] | Irrigation Efficiency [g] | Irrigation Demand [h] (in/acre) | Percent of Annual Demand | Monthly Peaking Factor | Days/Month | Unit Area (acres) | Monthly Irrigation Demand (af/acre-month) | Daily Average Flow (mgd) |
| 1 | January | 1.05 | 0.73 | 0.77 | 6.81 | 0.95 | 1.93 | 75% | 1.1 | 80% | 0.00 | 0% | 0.00 | 31 | 1 | 0.00 | 0.000 |
| 2 | February | 0.40 | 2.12 | 0.85 | 0.27 | 1.66 | 1.81 | 75% | 1.1 | 80% | 0.00 | 0% | 0.00 | 28 | 1 | 0.00 | 0.000 |
| 3 | March | 0.36 | 4.01 | 1.43 | 1.34 | 3.18 | 2.18 | 75% | 1.1 | 80% | 0.00 | 0% | 0.00 | 31 | 1 | 0.00 | 0.000 |
| 4 | April | 0.38 | 5.56 | 2.10 | 0.22 | 4.19 | 1.60 | 75% | 1.1 | 80% | 0.52 | 1% | 0.17 | 30 | 1 | 0.04 | 0.000 |
| 5 | May | 0.75 | 7.32 | 5.47 | 0.21 | 6.23 | 0.47 | 75% | 1.1 | 80% | 5.92 | 15% | 1.94 | 31 | 1 | 0.49 | 0.005 |
| 6 | June | 0.83 | 7.58 | 6.29 | 0.20 | 6.74 | 0.11 | 75% | 1.1 | 80% | 7.57 | 19% | 2.48 | 30 | 1 | 0.63 | 0.007 |
| 7 | July | 0.84 | 7.98 | 6.69 | 0.13 | 7.20 | 0.00 | 75% | 1.1 | 80% | 8.30 | 20% | **2.72** | 31 | 1 | 0.69 | 0.007 |
| 8 | August | 0.86 | 6.76 | 5.78 | 0.34 | 6.31 | 0.09 | 75% | 1.1 | 80% | 7.33 | 18% | 2.40 | 31 | 1 | 0.61 | 0.006 |
| 9 | September | 0.78 | 5.39 | 4.20 | 0.07 | 4.74 | 0.05 | 75% | 1.1 | 80% | 5.02 | 12% | 1.64 | 30 | 1 | 0.42 | 0.005 |
| 10 | October | 0.63 | 3.47 | 2.20 | 0.64 | 3.06 | 0.64 | 75% | 1.1 | 80% | 2.01 | 5% | 0.66 | 31 | 1 | 0.17 | 0.002 |
| 11 | November | 0.40 | 1.05 | 0.42 | 4.15 | 1.36 | 1.35 | 75% | 1.1 | 80% | 0.00 | 0% | 0.00 | 30 | 1 | 0.00 | 0.000 |
| 12 | December | 0.88 | 0.99 | 0.87 | 2.12 | 0.79 | 3.46 | 75% | 1.1 | 80% | 0.00 | 0% | 0.00 | 31 | 1 | 0.00 | 0.000 |
| 13 | **Annual Total** | | **52.96** | | | | **13.68** | | | | **36.7** | **90%** | | **365** | | **3.06 afy/acre** | **0.033** |
| 14 | **Average** | | **4.41** | | | | **1.14** | | | | **3.1** | | | | | **0.25** | **0.003** |

Footnotes:

a Equals C/B
b Source: ITRC
c From CIMIS Station #166 (Lodi West), Sept 2000 to Present
d From CIMIS Station #166 (Lodi West), Sept 2000 to Present
e Assumed to be 75 percent infiltration rate into the vegetation root zone
f Represents a 10 percent leaching rate through the vegetation root zone
g Assumes efficiency of 80 percent (i.e., 20 percent of applied irrigation water is lost to evaporation)
h Irrigation demand calculated using Methodology A;equals {[(A*E)-(F*G)]*H}/I
i equals J/J13
j equals J/J14
k equals (N/12)/J
l equals (O/M)*(325,851.4/1,000,000)

# Attachment E: Water Quality Information

**Table E-1: WSWPCF Effluent Water Quality[a]**

| Constituent | Units | Range | Average | Number of Samples |
|---|---|---|---|---|
| Ammonia | mg/L | 0.03 - 25 | 2 | 207 |
| Nitrate | mg/L as N | 1.4 - 12.9 | 5.9 | 24 |
| Calcium | mg/L | | Not tested | |
| Chloride | mg/L | | Not tested | |
| Chlorine residual | mg/L | Not detected | | 699 |
| Electrical Conductivity | mmhos/cm | 0.53 - 0.97 | 0.63 | 699 |
| Hardness | mg/L as $CaCO_3$ | 102 - 128 | 118 | 13 |
| | meq/L | 2 - 3 | 2 | |
| Magnesium | mg/L | 8.7 - 14 | 12 | 24 |
| | meq/L | 0.7 - 14 | 0.99 | |
| pH | pH units | 6.2 – 8.0 | 7.0 | 689 |
| Alkalinity | mg/L as $CaCO_3$ | 120 - 230 | 153 | 24 |
| Bicarbonate | mg/L as $HCO_3$ | 150 - 290 | 188 | 24 |
| | meq/L | 2.5 - 4.8 | 3.1 | |
| Phosphorus | mg/L | 140 - 1200 | 338 | 8 |
| Sodium | mg/L | 66 - 85 | 73 | 24 |
| | meq/L | 2.9 - 3.7 | 3 | |
| Silica | mg/L as $SiO_2$ | 65 - 72 | 69 | 24 |
| Temperature | degF | 60 - 88 | 73 | 694 |
| Total Dissolved Solids | mg/L | 150 - 540 | 377 | 24 |
| Total Suspended Solids | mg/L | 0.1 - 22 | 3 | 663 |
| Aluminum | ug/L | Not detected – 40 | 35 | 6 |
| Arsenic | ug/L | 2 - 4 | 3 | 13 |
| Beryllium | ug/L | Not detected (1) | | 8 |
| Boron | ug/L | 190 - 240 | 200 | 24 |
| Cadmium | ug/L | Not detected (1) | | 8 |
| Chromium | ug/L | Not detected (5) | | 8 |
| Cobalt | ug/L | | Not tested | |
| Copper | ug/L | Not detected - 13 | 3 | 2 - 13 |
| Fluoride | mg/L | 0.1 - 0.54 | 0.20 | 24 |
| Iron | ug/L | 100 - 200 | 100 | 24 |
| Lead | ug/L | Not detected - 1 | 1 | 20 |
| Lithium | ug/L | | Not tested | |
| Manganese | ug/L | 11.7 - 41.6 | 27.6 | 12 |
| Molybdenum | ug/L | | Not tested | |
| Nickel | ug/L | Not detected (5) | | 8 |
| Selenium | ug/L | Not detected (20) | | 8 |
| Vanadium | ug/L | | Not tested | |
| Zinc | ug/L | 2.5 - 69 | 33.9 | 22 |
| **CALCULATED VALUES** | | | | |
| SAR | | | 2.9 | |
| Adjusted SAR | | | 4.0 | |

Footnotes:

i. Recycled water monitoring data provided by West Yost Associates. Non-detects assumed to be equal to one half of the detection limit for averaging purposes.

**Table E-2: Groundwater, Surface Water, and Blended Water Quality**

| Constituent | Units | Groundwater Quality[a] | Surface Water Quality[b] | Blended Water Quality (Estimated)[c] |
|---|---|---|---|---|
| Ammonia | mg/L as N | Not tested | 0.03 | *Unknown* |
| Nitrate | mg/L as N | 2 | Not tested | *Unknown* |
| Calcium | mg/L | 29 | 5 | *19* |
| | meq/L | 1.4 | 0.2 | *0.9* |
| Chloride | mg/L | 15 | 2 | *10* |
| Chlorine residual | mg/L | Not applicable | 1.8 | *Unknown* |
| Electrical Conductivity | mmhos/cm | 0.34 | 0.05 | *0.22* |
| Hardness | mg/L as $CaCO_3$ | 129 | 18 | *83* |
| | meq/L | 3 | 0.4 | *2* |
| Magnesium | mg/L | Not tested | 1.5 | *Unknown* |
| | meq/L | | 0.12 | |
| pH | pH units | 7.2 | 7.3 | *7.3* |
| Alkalinity | mg/L as $CaCO_3$ | 134 | 19 | *87* |
| Bicarbonate | mg/L as $HCO_3$ | 164 | 24 | *107* |
| | meq/L | 2.7 | 0.4 | *1.7* |
| Phosphorus | mg/L | Not tested | 0.03 | *Unknown* |
| Sodium | mg/L | 22 | 3 | *14.0* |
| | meq/L | 0.9 | 0.1 | *0.6* |
| Silica | mg/L as $SiO_2$ | Not tested | 9 | *Unknown* |
| Temperature | degF | Not tested | 59 | *Unknown* |
| Total Dissolved Solids | mg/L | 249 | 37 | *162* |
| Total Suspended Solids | mg/L | Not tested | 10 | *Unknown* |
| Aluminum | ug/L | 44 | 22 | *34.7* |
| Arsenic | ug/L | 4 | 0.8 | *2.9* |
| Beryllium[d] | ug/L | Not detected (1) | 0.3 | *Unknown* |
| Boron | ug/L | Not tested | Not tested | *Unknown* |
| Cadmium[d] | ug/L | Not detected (1) | 0.6 | *Unknown* |
| Chromium[d] | ug/L | Not detected (10) | 1.1 | *Unknown* |
| Cobalt | ug/L | Not tested | 1.2 | *Unknown* |
| Copper | ug/L | Not detected (50) | 3.2 | *Unknown* |
| Fluoride | mg/L | 0.10 | 0.07 | *0.1* |
| Iron | ug/L | 56 | 67 | *60.2* |
| Lead | ug/L | Not detected (5) | 1.6 | *Unknown* |
| Lithium | ug/L | Not tested | 2.3 | *Unknown* |
| Manganese | ug/L | Not detected (20) | 7.7 | *Unknown* |
| Molybdenum | ug/L | Not tested | Not detected (5) | *Unknown* |
| Nickel | ug/L | Not detected (10) | 0.8 | *Unknown* |
| Selenium | ug/L | Not detected (5) | Not tested | *Unknown* |
| Vanadium | ug/L | Not tested | Not tested | *Unknown* |
| Zinc | ug/L | 25 | 10.6 | *18.9* |
| **CALCULATED VALUES** | | | | |
| SAR[e] | | *0.8* | 0.3 | *0.9* |
| Adjusted SAR[e] | | *0.7* | 0.2 | *0.6* |

Footnotes:

a. Groundwater quality is reported as the range and average concentrations for all wells in 2005. Non-detects assumed to be equal to one half of the detection limit for averaging purposes.

b. Surface water quality reported as the average of data reported by USGS for Station 11325500 (Mokelumne River at Woodbridge, CA) for 1973 through 1994 (website: M:\Lodi WTP\WQ Data\Woodbridge\WQN Station 11325500 MOKELUMNE R A WOODBRIDGE CA.htm) with monitoring data collected by the City of Lodi at four locations from May, 2006 through April of 2007. Non-detects assumed to be equal to one half of the detection limit for averaging purposes.

c. Estimated values in italics. Assumes 6,000 AFY delivered in months March through October beginning in 2011. Based on projected demands for 2012 as developed for the City of Lodi 2005 Urban Water Management Plan, surface water would comprise approximately 41% of supply on a monthly basis during these months. **Blended water quality assumes conservative behavior of constituents.**

d. Numbers in parentheses are one-half of the method detection limit.

e. Because groundwater magnesium data is not available, SAR and adjusted SAR for groundwater were estimated using hardness as a surrogate value for calcium plus magnesium.

**Table E-3: Anticipated Changes to Recycled Water Quality**

| Constituent | Units | Estimated Reduction in Concentration with Surface Water | Projected Future Recycled Water Quality[a] | Anticipated Change[a] | Notes |
|---|---|---|---|---|---|
| Ammonia | mg/L as N | *Unknown* | *Unknown* | *Unknown* | Change in concentrations unknown |
| Nitrate | mg/L as N | *Unknown* | *Unknown* | *Unknown* | Change in concentrations unknown |
| Calcium | mg/L | *34%* | *19* | *Reduction* | Reduction in source hardness |
| | meq/L | | *1.0* | | |
| Chloride | mg/L | *36%* | *41* | *Reduction* | Reduction in source chloride |
| Chlorine residual | mg/L | *Unknown* | *Unknown* | *Unknown* | Surface water disinfection requirement |
| Electrical Conductivity | mmhos/cm | *35%* | *0.4* | *Reduction* | Reduction in source EC |
| Hardness | mg/L as $CaCO_3$ | *35%* | *76* | *Reduction* | Reduction in source hardness |
| | meq/L | | *1.5* | | |
| Magnesium | mg/L | *Unknown* | *Unknown* | *Reduction* | Reduction in source hardness |
| | meq/L | | | | |
| pH | pH units | *0%* | *6.9* | *No change* | Similar pH, significantly higher alkalinity in groundwater |
| Alkalinity | mg/L as $CaCO_3$ | *35%* | *99* | *Reduction* | Estimated based on mass balance |
| Bicarbonate | mg/L as $HCO_3$ | *35%* | *122* | *Reduction* | Estimated based on mass balance |
| | meq/L | | *2.0* | | |
| Phosphorus | mg/L | *Unknown* | *Unknown* | *Unknown* | Change in concentrations unknown |
| Sodium | mg/L | *35%* | *47.4* | *Reduction* | Reduction in source sodium |
| | meq/L | | *2.1* | | |
| Silica | mg/L as $SiO_2$ | *Unknown* | *Unknown* | *Unknown* | Change in concentrations unknown |
| Temperature | degF | *Unknown* | *Unknown* | *Unknown* | Temperature changes driven by use |
| Total Dissolved Solids | mg/L | *35%* | *245* | *Reduction* | Reduction in source TDS |
| Total Suspended Solids | mg/L | *Unknown* | *Unknown* | *Unknown* | Change in concentrations unknown |
| Aluminum | ug/L | *20%* | *28* | *Reduction* | Reduction in source aluminum |
| Arsenic | ug/L | *34%* | *2* | *Reduction* | Reduction in source arsenic |
| Beryllium | ug/L | *Unknown* | *Unknown* | *Unknown* | Change in concentrations unknown |
| Boron | ug/L | *Unknown* | *Unknown* | *Unknown* | Change in concentrations unknown |
| Cadmium | ug/L | *Unknown* | *Unknown* | *Unknown* | Change in concentrations unknown |
| Chromium | ug/L | *Unknown* | *Unknown* | *Unknown* | Change in concentrations unknown |
| Cobalt | ug/L | *Unknown* | *Unknown* | *Unknown* | Change in concentrations unknown |
| Copper | ug/L | *Unknown* | *Unknown* | *Unknown* | Change in concentrations unknown |
| Fluoride | mg/L | *12%* | *0.2* | *Reduction* | Reduction in source fluoride |
| Iron | ug/L | *8%* | *108* | *Increase* | Increase in source iron |
| Lead | ug/L | *Unknown* | *Unknown* | *Unknown* | Change in concentrations unknown |
| Lithium | ug/L | *Unknown* | *Unknown* | *Unknown* | Change in concentrations unknown |
| Manganese | ug/L | *Unknown* | *Unknown* | *Unknown* | Change in concentrations unknown |
| Molybdenum | ug/L | *Unknown* | *Unknown* | *Unknown* | Change in concentrations unknown |
| Nickel | ug/L | *Unknown* | *Unknown* | *Unknown* | Change in concentrations unknown |
| Selenium | ug/L | *Unknown* | *Unknown* | *Unknown* | Change in concentrations unknown |
| Vanadium | ug/L | *Unknown* | *Unknown* | *Unknown* | Change in concentrations unknown |
| Zinc | ug/L | *23%* | *26* | *Reduction* | Reduction in source zinc |
| **CALCULATED VALUES** | | | | | |
| SAR | | | *3.1* | *Increase* | |
| adjSAR | | | *3.9* | *Reduction* | |

Footnotes:

a. Estimated values are italicized. For the purposes of this analysis, it was assumed that recycled water quality concentrations will change in proportion to the change in drinking water parameter concentrations resulting from blending groundwater and surface water supplies. Refer to Table E-3 for estimated blended drinking water quality.

SAR is the ratio of the concentration of sodium ions to the concentration of calcium plus magnesium as shown in the following equation.

$$SAR = \frac{[Na]}{\sqrt{([Ca]+[Mg]) \div 2)}}$$

An adjusted SAR should be used when the carbonates or bicarbonates are high. For example, for bicarbonate content greater than 2.0 milliequivalents per liter (meq/L, 120 parts per million, ppm) and carbonate content greater than 0.5 meq/L (15 ppm).[7] The adjusted SAR is calculated by the following formula.[8]

$$Adjusted\ SAR = \frac{[Na]}{\sqrt{([HCO_3]/([Ca]+[Mg]) \div 2)}}$$

This method includes the added effects of precipitation and dissolution of calcium in soils and is related to carbonate/bicarbonate concentration. Cation and bicarbonate concentrations are expressed in meq/L.

**Table E-4: Guidelines for Trace Elements in Irrigation Supplies[9,10]**

| Element | Recommended Maximum Concentration (ug/L) | Notes |
|---|---|---|
| Aluminum | 5000 | Can cause non-productivity in acid soils (pH < 5.5), but more alkaline soils at pH > 7.0 will precipitate the ion and eliminate any toxicity. |
| Arsenic | 100 | Toxicity to plants varies widely, ranging from 12 mg/l for Sudan grass to less than 0.05 mg/l for rice. |
| Beryllium | 100 | Toxicity to plants varies widely, ranging from 5 mg/l for kale to 0.5 mg/l for bush beans. |
| Cadmium | 10 | Toxic to beans, beets and turnips at concentrations as low as 0.1 mg/l in nutrient solutions. Conservative limits recommended due to its potential for accumulation in plants and soils to concentrations that may be harmful to humans. |
| Chromium | 100 | Not generally recognized as an essential growth element. Conservative limits recommended due to lack of knowledge on its toxicity to plants. |
| Cobalt | 50 | Toxic to tomato plants at 0.1 mg/l in nutrient solution. Tends to be inactivated by neutral and alkaline soils. |
| Copper | 200 | Toxic to a number of plants at 0.1 to 1.0 mg/l in nutrient solutions. |
| Fluoride | 1000 | Inactivated by neutral and alkaline soils. |
| Iron | 5000 | Not toxic to plants in aerated soils, but can contribute to soil acidification and loss of availability of essential phosphorus and molybdenum. Overhead sprinkling may result in unsightly deposits on plants, equipment and buildings. |
| Lead | 5000 | Can inhibit plant cell growth at very high concentrations. |
| Lithium | 2500 | Tolerated by most crops up to 5 mg/l; mobile in soil. Toxic to citrus at low concentrations (<0.075 mg/l). Acts similarly to boron. |
| Manganese | 200 | Toxic to a number of crops at a few-tenths to a few mg/l, but usually only in acid soils. |
| Molybdenum | 10 | Not toxic to plants at normal concentrations in soil and water. Can be toxic to livestock if forage is grown in soils with high concentrations of available molybdenum. |
| Nickel | 200 | Toxic to a number of plants at 0.5 mg/l to 1.0 mg/l; reduced toxicity at neutral or alkaline pH. |
| Selenium | 20 | Toxic to plants at concentrations as low as 0.025 mg/l and toxic to livestock if forage is grown in soils with relatively high levels of added selenium. As essential element to animals but in very low concentrations. |
| Titanium | - | Effectively excluded by plants; specific tolerance unknown. |
| Tungsten | | |
| Vanadium | 100 | Toxic to many plants at relatively low concentrations. |
| Zinc | 2000 | Toxic to many plants at widely varying concentrations; reduced toxicity at pH > 6.0 and in fine textured or organic soils. |
| pH | 6.0 | Most effects of pH on plant growth are indirect (e.g., pH effects on heavy metal toxicity) |

[7] Carrow, R.N. and R.R. Duncan, 1998. Salt-Affected Turfgrass Sites. Ann Arbour Press.
[8] Equation given by Caltest Laboratories, November 2004.
[9] Pescod, M.B. Wastewater Quality Guidelines for Agricultural Use, Table 10. Food and Agriculture Organization of the United Nations, Paper 47, Rome, 1992. Converted to ug/L from mg/L. Website: http://www.fao.org/docrep/T0551E/T0551E00.htm
[10] United States Environmental Protection Agency, September 2004. Guidelines for Water Reuse.

**Table E-5: Constituents of Interest for Industrial Cooling Water Processes[11,12]**

| Element | Effects | Maximum Recommended Concentration | Units |
|---|---|---|---|
| Calcium | Calcium is particularly troublesome because certain calcium salts exhibit an inverse solubility in water. Unlike most salts in solution, which become more soluble with increasing temperature, calcium carbonate becomes less soluble with increasing temperature. | 900 | mg/L |
| Magnesium * Silicon Dioxide | Magnesium is usually not a problem unless silica levels are also high, resulting in magnesium silicate scale in the heat exchangers. | 35,000 (without scale inhibitor), 75,000 (with scale inhibitor) | $mg^2/L^2$ |
| Alkalinity | Bicarbonates normally dominate measured alkalinity. Under certain conditions, appreciable amounts of carbonate and hydroxide alkalinity may also be present. Alkalinity is an important means of predicting calcium carbonate scale potential. | 30 (without scale inhibitor), 50 (with scale inhibitor) | mg/L as $CaCO_3$ |
| Silica | Can produce difficult-to-remove scale deposits. Pretreatment or sidestream filtration is often required if the silica levels are above 150 mg/L (as SiO2). | 150 | mg/L |
| Total Suspended Solids | Not all suspended solids enter the cooling system with the makeup water. Some might be generated as corrosion and scale byproducts or from air/water contact. Suspended solids can adhere to biofilms and cause under-deposit corrosion. | 100 - 300 | mg/L |
| Total Dissolved Solids | Dissolved solids are concentrated in cooling processes, and can cause scaling and corrosion. | 70,000 | mg/L |
| Ammonia | Ammonia can promote biofilm development and growth in heat exchangers and cooling tower fill. It is also extremely corrosive to even well-passivated copper alloys at concentrations as low as 2.0 mg/L. Ammonia can combine with chloride to form chloramines which are volatile and are easily stripped from the water as it passes the tower, negating any disinfecting affect. | 2.0 | mg/L |
| Phosphate | Concentration levels equal to or less than 4.0 mg/L may not be a concern if the pH is controlled between 7.0 and 7.5 and there is a sufficient amount of dispersant. At this level the phosphate can provide a mild steel corrosion protection since phosphate is a common anionic inhibitor (although the system should not rely on recycled water as the only source for corrosion protection since the levels may fluctuate). At higher concentrations (calcium greater than 1,000 mg/L and phosphate greater than 20 mg/L) there is a potential for calcium phosphate scaling in the heat exchangers, especially at high heat loads and low cooling water flow rates. Phosphate can also act as a nutrient for biofilms | 5.0 | mg/L as orthoP |
| Chloride | Can be corrosive to most metals, especially mild steel. A chloride limit of 300 mg/L is often used for stainless steel, but limits for other metals may go as high as 1,000 mg/L. | 300-1000 | mg/L |
| Iron | Iron can combine with phosphate to form undesirable foulants, and may deactivate specialized polymers used to inhibit calcium phosphate scaling. | 0.5 | mg/L |
| Manganese | Elevated manganese concentrations can cause scaling. | 0.5 | mg/L |
| Sulfide | Sulfides can create scale-forming compounds, or under certain circumstances, an odor nuisance. | 5 | mg/L |
| Biological Oxygen Demand | Reflects the organic content for biological organisms and the associated demand for oxidizing biocide in addition to the amount used for bio fouling control. | No established value | |
| Nitrate+ Nitrite | Provides mild steel corrosion control at levels above 300 mg/L in the concentrated cooling water. Can contribute to reductions in stainless steel cracking and pitting erosion. Nitrates do not attack copper alloys or protect them from corrosion. | 300 | mg/L |
| Zinc | Can assist phosphates and nitrates in reducing mild steel corrosion rates and pitting tendencies. Levels in cooling water above 0.5 mg/L are beneficial, but levels above 3.0 mg/L can contribute to deposits. | 0.5-3.0 | mg/L |
| Organics | Can act as fertilizer for microorganisms. Water-soluble cationic polymers can react with some anionic treatment biocides, as well as some scale and corrosion inhibitors. | No established value | |
| Fluoride | At 10 mg/L or more can combine with calcium to cause scale formation. | 10 | mg/L |
| Copper | Copper can plate out on steel, causing localized galvanic corrosion that can rapidly penetrate thin steel heat exchanger tubes. | 0.1 | mg/L |
| Aluminum | Iron, copper, and aluminum can be generated as by-products of corrosion in the cooling system as a result of poor pH control or improper corrosion inhibition. | 1.0 | mg/L |

[11] Loretitsch, Gary. Puckorius & Associates. Guidelines for Managing Water in Cooling Systems For Owners, Operators, and Environmental Managers, Table 2.05.
[12] DiFillippo, Michael N. Cooling Tower Water Quality Parameters for Degraded Water, Table 2-1. Prepared for the California Energy Commission, April 2006 (CEC-500-2005-170).

**Table E-6: Effect of Water Quality Constituents on Cooling System Component Materials[13]**

| Type of Material | Effect of Water Quality Constituents |
|---|---|
| Galvanized Iron (copper and zinc coating) | Susceptible to corrosion (white rust) from high dissolved solids, particularly chloride and heavy metals; pH below 6.5 or above 8.5 |
| Stainless Steel | Susceptible to corrosion (at lower rates than for mild steel) due to high dissolved solids—primarily chlorides that can cause stress corrosion cracking (SCC) or severe pitting. In the 304-SS alloy, chloride levels above 200 mg/l are of concern when deposit-forming conditions exist, but levels as high as 1,000 mg/l chloride levels do not cause corrosion in the absence of deposits. The 316-SS alloy can tolerate chloride levels of 5,000 mg/l when deposit-forming conditions exist, and 30,000 mg/l when surfaces are free of deposits. Biomass deposits can cause rapid pitting. Nitrates are known to reduce stainless steel corrosion. |
| Mild Steel | Susceptible to corrosion from high total dissolved solids; deposit-forming constituents such as suspended solids, biomass, and scale; heavy metals, such as copper. Ammonia contributes indirectly to steel corrosion through increases to biomass. |
| Copper alloys including Admiralty Brass and Muntz metal | Susceptible to corrosion from ammonia, high dissolved solids, and deposit-forming constituents such as suspended solids. Ammonia above 0.5 mg/l as NH3 can cause cracking of brass (Admiralty), severe corrosion of copper alloys, and contributes to biomass that can cause corrosion to copper alloy under deposits. The cracking of brass can be rapid and severe. Chloramines (chlorine plus ammonia) can cause cracking. |
| Wood | Needs to be protected from decay or chemical attack. |
| Plastics | Should be kept clean and free of deposits to prevent clogging, etc. Plastic film in particular needs to be kept clean and free of biomass buildup. |

**Table E-7: Recommended Industrial Boiler Feed Water Quality Criteria[14]**

| Parameter | Recommended Maximum Concentration by Pressure Level (mg/L) | | |
|---|---|---|---|
| | Low (<150 psig) | Intermediate (150-700 psig) | High (>700 psig) |
| Silica | 30 | 10 | 0.7 |
| Aluminum | 5 | 0.1 | 0.01 |
| Iron | 1 | 0.3 | 0.05 |
| Manganese | 0.3 | 0.1 | 0.01 |
| Calcium | None identified | 0.4 | 0.01 |
| Magnesium | None identified | 0.25 | 0.01 |
| Ammonia | 0.1 | 0.1 | 0.1 |
| Bicarbonate | 170 | 120 | 48 |
| Total Dissolved Solids | 700 | 500 | 200 |
| Copper | 0.5 | 0.05 | 0.05 |
| Zinc | None identified | 0.01 | 0.01 |
| Total Hardness | 35.0 | 1.0 | 0.07 |
| Alkalinity | 350 | 100 | 40 |
| pH, units | 7.0 – 10.0 | 8.2 – 10.0 | 8.2 – 9.0 |
| Chemical oxygen demand | 5 | 5 | 1.0 |
| Dissolved oxygen | 2.5 | 0.07 | 0.0007 |
| Total Suspended Solids | 10 | 5 | 0.5 |

[13] Loretitsch, Gary. Puckorius & Associates. Guidelines for Managing Water in Cooling Systems For Owners, Operators, and Environmental Managers, Table 2.01.
[14] Loretitsch, Gary. Puckorius & Associates. Guidelines for Managing Water in Cooling Systems For Owners, Operators, and Environmental Managers, Table 2.01.

**Table E-8: Water Quality Requirements for Industrial Processes[15]**

| Parameter | Maximum Recommended Concentration by Industry (mg/L) | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | Pulp & Paper | | | | | Textiles | | |
| | Mech. piping | Chemical, Unbleached | Pulp & Paper Bleached | Chemical | Petro-chemical & Coal | Sizing Suspension | Scouring, Bleach & Dye | Cement |
| Copper | - | - | - | - | 0.05 | 0.01 | - | - |
| Iron | 0.3 | 1.0 | 0.1 | 0.1 | 1.0 | 0.3 | 0.1 | 2.5 |
| Manganese | 0.1 | 0.5 | 0.05 | 0.1 | - | 0.05 | 0.01 | 0.5 |
| Calcium | - | 20 | 20 | 68 | 75 | - | - | - |
| Magnesium | - | 12 | 12 | 19 | 30 | - | - | - |
| Chloride | 1,000 | 200 | 200 | 500 | 300 | - | - | 250 |
| Bicarbonate | - | - | - | 128 | - | - | - | - |
| Nitrate | - | - | - | 5 | - | - | - | - |
| Sulfate | - | - | - | 100 | - | - | - | 250 |
| Silicon Dioxide | - | 50 | 50 | 50 | - | - | - | 35 |
| Hardness | - | 100 | 100 | 250 | 350 | 25 | 35 | - |
| Alkalinity | - | - | - | 125 | - | - | - | 400 |
| Total Dissolved Solids | - | - | - | 1,000 | 1,000 | 100 | 100 | 600 |
| Total Suspended Solids | - | 10 | 10 | 5 | 10 | 5 | 5 | 500 |
| Color | 30 | 30 | 10 | 20 | - | 5 | 5 | - |
| pH | 6-10 | 6-10 | 6-10 | 6.2-8.3 | 6-9 | - | - | 6.5-8.5 |

Footnotes:

a. Concentrations are reported as mg/L for all parameters except pH, which is in pH units.

[15] United States Environmental Protection Agency, September 2004. Guidelines for Water Reuse, Table 2-4.

# Appendix C Conceptual Alternatives TM

# FINAL Technical Memorandum

**Lodi Recycled Water Master Plan**

| | |
|---|---|
| **Subject:** | **Conceptual Recycled Water Alternatives** |
| **Prepared For:** | Lyman Chang, City of Lodi |
| **Prepared by:** | Andy Smith, Oscar Biondi |
| **Reviewed by:** | Deana Donohue, Helene Kubler, Glenn Hermanson |
| **Date:** | September 26, 2007 |
| **Reference:** | 0140-003.3 |

## 1 Introduction

The purpose of this technical memorandum (TM) is to present the conceptual recycled water alternatives developed as part of the City of Lodi Recycled Water Master Plan (RWMP). Based on this TM, the preferred conceptual alternative will be selected by the City, and later will be evaluated during the development of the Draft RWMP document.

The preferred alternatives will meet the following project objectives to the maximum extent practicable:

- Take full advantage of high quality recycled water to reduce groundwater overdraft, by providing recycled water to the maximum number of potential users while operating within the preferred design criteria;
- Improve water supply reliability by providing recycled water during peak demand periods; and
- Provide an interim solution for the use of the City's untreated WID water.

This TM is organized as follows:

- Introduction
- Project Alternative Definition
- Alternatives Demand Allocation
- Evaluation Criteria
- Conclusions

## 2 Project Alternative Definition

Four conceptual alternatives were developed based on discussions with City staff and the results of the Recycled Water Market Assessment conducted for this RWMP. The assumptions regarding available water supplies were based on the potential recycled water and non-potable water supplies presented in the *Draft Recycled Water Market Assessment TM* (RMC, 2007) and *Draft Key Assumptions TM* (RMC, 2007). The alternative designations do not reflect a preferred alternative or anticipated timing of implementation. The City does not anticipate the need to extend the recycled water system east of Highway 99 because of economic feasibility; hence, each of the conceptual alternatives includes pipes to the west of Highway 99 only.

Alternatives A, B, C, and D provide options for delivering recycled water (RW) from the White Slough Water Pollution Control Facility (WPCF) to specific potential users within the City's Recycled Water

Service Area (RWSA). Alternatives A, B, and C use Woodbridge Irrigation District (WID) water in addition to the recycled water from the WPCF to meet customer peak irrigation demands, while Alternative D uses recycled water from the White Slough WPCF only. It should be noted that a recycled water system could be designed to meet fire flow demands, but this analysis has not been performed to date. A regional alternative for the use of recycled water is not addressed in this TM. Instead, Lodi is working with the City of Stockton to evaluate a regional alternative for the use of Lodi's available recycled water supplies in parallel with this Master Plan (refer to Section 2.1 for more information about this study).

The proposed conceptual alternatives descriptions are presented in Section 2.1. Based on City-provided comments and feedback on the conceptual alternatives presented in this technical memorandum, further refinement and evaluation of the alternatives, including a discussion of potential storage requirements, will occur and will be presented in the Draft RWMP document. The proposed evaluation criteria are presented in Section 4.

The key characteristics for each alternative are summarized and presented in **Table 1**.

**Table 1: Conceptual Recycled Water Alternatives**

| Alternative | | A | B | C | D-1 [g] | D-2 [h] |
|---|---|---|---|---|---|---|
| **Customer Information** | No. of schools served/total [a] | 8/19 | 12/19 | 10/19 | 0/19 | 0/19 |
| | No. of parks served/total [b] | 17/36 | 17/36 | 15/36 | 0/36 | 0/36 |
| | Acres of potential agricultural customers served [c] | 800 | 810 | 877 | 1,133 | 1,183 |
| **Approximate length** | feet | 86,100 | 94,300 | 78,300 | 37,000 | 28,800 |
| | miles | 16.3 | 17.9 | 14.8 | 7.0 | 5.5 |
| **Looped System** | | Yes | Yes | No | No | Yes |
| **Major Facilities** | | ▪ Two pump stations<br>▪ Seasonal storage pond(s) | ▪ Two pump stations<br>▪ Seasonal storage pond(s) | ▪ Two pump stations<br>▪ Seasonal storage pond(s) | ▪ One pump station<br>▪ Seasonal storage pond(s) | ▪ One pump station<br>▪ Seasonal storage pond(s) |
| **Total Demand (RW Yield)** | ADD [d] (mgd) | 5.2 | 5.2 | 5.2 | 3.3 | 3.3 |
| | MDD [e] (mgd) | 14.4 | 14.4 | 14.4 | 8.5 | 8.5 |
| | MHD [f,j] (mgd) | 19.7 | 19.7 | 19.9 | 14.5 | 14.5 |
| **Interim WID Water Use** | | Yes | Yes | Yes | No [i] | No [i] |

Footnotes:

a. A total of 19 schools were identified as potential recycled water customers in the *Draft Recycled Water Market Assessment TM* (RMC, 2007)
b. A total of 36 parks were identified as potential recycled water customers in the *Draft Recycled Water Market Assessment TM* (RMC, 2007).
c. Acreages differ among the alternatives due to 1) differing amounts of supply remaining after meeting demands from non-agricultural potential users under each alternative, and 2) the differing irrigation demands for the crop types assumed for potential agricultural users assigned to each alternative.
d. Average Day Demand.
e. Maximum Day Demand. Assumes that the existing NCPA facility is not operating.
f. Maximum (Peak) Hour Demand. Assumes that the existing NCPA facility is not operating.
g. Non-looped alternative
h. Looped alternative
i. Interim WID water use may be feasible by diverting water from WID canals other than the South Main Canal, but doing so would require modification of the City's water supply agreement with WID.
j. Represents agricultural irrigation and potential NCPA facility demands. Assumes daytime irrigation for agricultural demands, and nighttime irrigation for urban demands.

## 2.1 Alternative Descriptions

This section presents the conceptual alternatives alignment descriptions. Based on a preliminary evaluation, recommendations have been provided for consideration.

### No Project Alternative

In addition to the four conceptual project alternatives discussed above, a "No Project" Alternative will also be considered. The "No Project Alternative" is a scenario in which a recycled water system is not implemented within the City. The selection of a "No Project" Alternative would limit the City's ability to reduce the wastewater discharges or improve water supply reliability through the offset of potable water supplies.

It should also be noted that the City is participating in a joint study with the City of Stockton in order to examine the feasibility of a joint Stockton-Lodi recycled water system. The joint study is taking place concurrently with Lodi's RWMP. Based on preliminary findings, the joint project would likely utilize recycled water from Lodi's White Slough WPCF in and around the northern portion of Stockton, but would not use recycled water for agricultural irrigation.

### Alternative A - Harney Lane/WID Canal (Looped)

The main corridors of this alignment include: North Thornton Road, West Kingdon Road, Harney Lane, west edge of the future development areas (Westside and Southwest Gateway) west of Lower Sacramento Road between Harney Lane and the South Main WID canal, and along the South Main WID canal from Harney Lane to Turner Road. Based on preliminary modeling, Alternative A is approximately 86,000 lineal feet in total length (RW distribution main lines only), with pipe diameter sizes ranging from 6-inches to 24-inches.

During peak irrigation demand periods (June, July, and August), the recycled water supply from the White Slough WPCF will not be sufficient to meet the demand. Therefore, additional water supplies must be added to the recycled water distribution system in order to meet the increased demand. This water will come from a proposed WID canal intake/pump station assumed to be located in Beckman Park. A pump station will also be located at the White Slough WPCF. Although a location in Beckman Park has been proposed for the WID canal pump station based on City input, the actual location will be determined during the design phase for this project. One crossing of the WID canal is anticipated at Harney Lane under this alternative. Other crossings of the WID canal are expected for the distribution feeder pipelines serving the various schools and parks. Additionally, a seasonal storage pond or ponds would be necessary, based on the assumptions presented in the *Market Assessment TM*, in order to meet demands for this alternative. The layout for Alternative A is shown in **Figure 1**.

### Alternative B - Harney Lane/Ham Lane (Looped)

The main corridors of this alignment include: North Thornton Road, West Kingdon Road, Harney Lane, Ham Lane, West Elm Street, and the west edge of the future development areas (Westside and Southwest Gateway) west of Lower Sacramento Road from Harney Lane to Turner Road. Based on preliminary modeling, Alternative B is approximately 94,000 lineal feet in total length (RW distribution main lines only), with pipe diameter sizes ranging from 6-inches to 24-inches.

During peak irrigation demand periods (June, July, August), the recycled water supply from the White Slough WPCF will not be sufficient to meet the demand. Therefore, additional water supplies must be added to the recycled water distribution system in order to meet the increased demand. This water will come from a proposed WID canal intake/pump station assumed to be located in Beckman Park. A pump station will also be located at the White Slough WPCF. Although a location in Beckman Park has been proposed for the WID canal pump station based on City input, the actual location will be determined during the design phase for this project. One crossing of the WID canal is anticipated at Harney Lane

under this alternative. Additionally, a seasonal storage pond or ponds would be necessary, based on the assumptions presented in the *Market Assessment TM*, in order to meet demands for this alternative. The layout for Alternative B is shown in **Figure 2.**

## Alternative C - Harney Lane/Ham Lane (Non-looped)

The main corridors of this alignment include: North Thornton Road, West Kingdon Road, Harney Lane, Ham Lane, and adjacent to the future development areas (Westside and Southwest Gateway) west of Lower Sacramento Road from Harney Lane to West Lodi Avenue. Based on preliminary modeling, Alternative C is approximately 78,000 lineal feet in total length (RW distribution main lines only), with pipe diameter sizes ranging from 6-inches to 24-inches.

During peak irrigation demand periods (June, July, August), the recycled water supply from the White Slough WPCF will not be sufficient to meet the demand. Therefore, additional water supplies must be added to the recycled water distribution system in order to meet the increased demand This water will come from a proposed WID canal intake/pump station assumed to be located in Beckman Park. A pump station will also be located at the White Slough WPCF. Although a location in Beckman Park has been proposed for the WID canal pump station based on City input, the actual location will be determined during the design phase for this project. One crossing of the WID canal is anticipated at Harney Lane under this alternative. Additionally, a seasonal storage pond or ponds would be necessary, based on the assumptions presented in the *Market Assessment TM*, in order to meet demands for this alternative. The layout for Alternative C is shown in **Figure 3**.

## Alternative D - Agricultural Users Only

The main corridors of this alignment include Tredway Lane and Harney Lane. Based on preliminary modeling, Alternative D is approximately 29,000 lineal feet in total length (RW distribution main lines only), with pipe diameter sizes ranging from 16-inches to 24-inches. One pump station located at the White Slough WPCF would be necessary to provide a minimum pressure of 80 psi at customer connection points and meet the irrigation demands. Alternative D would only supply recycled water to agricultural and industrial customers west of Lower Sacramento Road. Additionally, a seasonal storage pond or ponds may be necessary, based on the assumptions presented in the *Market Assessment TM*, in order to meet demands for this alternative. Alternative D is illustrated in **Figure 4**.

A looped variation of this alternative was also considered, and is shown in **Figure 5**. The looped scenario serves customers west of the Union Pacific Railroad tracks, has a total length of approximately 37,000 lineal feet (RW distribution main lines only), and features the same pump station and pipe diameter size range as the non-looped scenario. Both looped and non-looped scenarios have a reduced effective service area during peak hour flows, due to increased NCPA power plant demands near the White Slough WPCF, as well as a limited recycled water supply. In other words, as demands increase towards the peak hourly demand, the percentage of potential agricultural users shown in Figures 4 and 5 that can be irrigated decreases.

## Qualitative Alternative Evaluation

A more detailed evaluation of the preferred conceptual alternatives will be completed during development of the Draft RWMP. In an effort to eliminate alternatives that may not be considered as a preferred alternative, RMC has reached the following preliminary conclusions and recommendations for the conceptual alternatives:

- Alternatives A, B, and C offer nearly identical recycled water and WID water usage. Alternative C is 1.5 miles and 3.1 miles shorter than Alternatives A and B, respectively. Based on preliminary modeling, it appears that Alternative C can provide adequate pressures under peak demand conditions using similar pumping capabilities as Alternatives A and B.

- Alternatives A and B both provide the benefits of a partially looped distribution system (i.e., consistent system pressures). Although Alternative B is 1.6 miles longer than Alternative A, Alternative B offers recycled water to the greatest number of schools and parks, and would likely be subject to fewer permitting and construction hurdles than Alternative A, as Alternative A would require a significant amount of construction along the main WID canal.
- The looped version of Alternative D is 1.5 miles shorter than the non-looped version, and is assumed to offer nearly identical recycled water usage.

During a meeting with the City to review the draft version of this TM, additional discussion of the alignment alternatives took place, resulting in the following assessments:

- Alternative A offers advantages over Alternatives B and C, due to the fact that there would be fewer utility crossings and less pavement disruption by following the South Main WID Canal.
- The looped version of Alternative D provides the benefits of a looped system, and could likely avoid crossing the UPRR tracks.
- Seasonal storage facilities could be designed and operated in several ways. Further evaluation of the selected alternatives will included conceptual development and analysis of seasonal storage facilities to meet the City's annual recycled water demands.

# 3 Alternatives Demand Allocation

A hydraulic model was created for all alternatives in an effort to select pipe sizes and to identify preliminary hydraulic deficiencies. Potential recycled water customers were assigned to each alternative alignment based on their proximity to the proposed distribution main alignments. In general, potential customers were assigned as follows:

### Within the City limits:

Potential customers within a distance of 1,000 feet from the proposed alignments were included

### In agricultural areas outside the City limits

Potential customers directly adjacent to the proposed alignments were considered. Due to the large number of potential customers in the agricultural areas and the limited quantity of available recycled water, not all users adjacent to the alignments were selected. Instead, customers' demands were incrementally assigned to the alternative until the desired total maximum day supply was reached.

Alternatives A, B and C were developed such that the maximum day (July) demands from their associated sets of potential recycled water customers equaled approximately 14.4 million gallons per day (mgd), which is equivalent to an assumed White Slough WPCF supply of 8.5 mgd and a WID supply of approximately 5.9 mgd. Alternative D was developed such that the maximum day demand equaled the anticipated supply of 8.5 mgd.

# 4 Evaluation Criteria

The proposed evaluation criteria, which will be used to identify and recommend the preferred alignment(s), are summarized in **Table 1**. The preferred alignment will ultimately be selected by the City.

**Table 1: Alternative Evaluation Criteria**

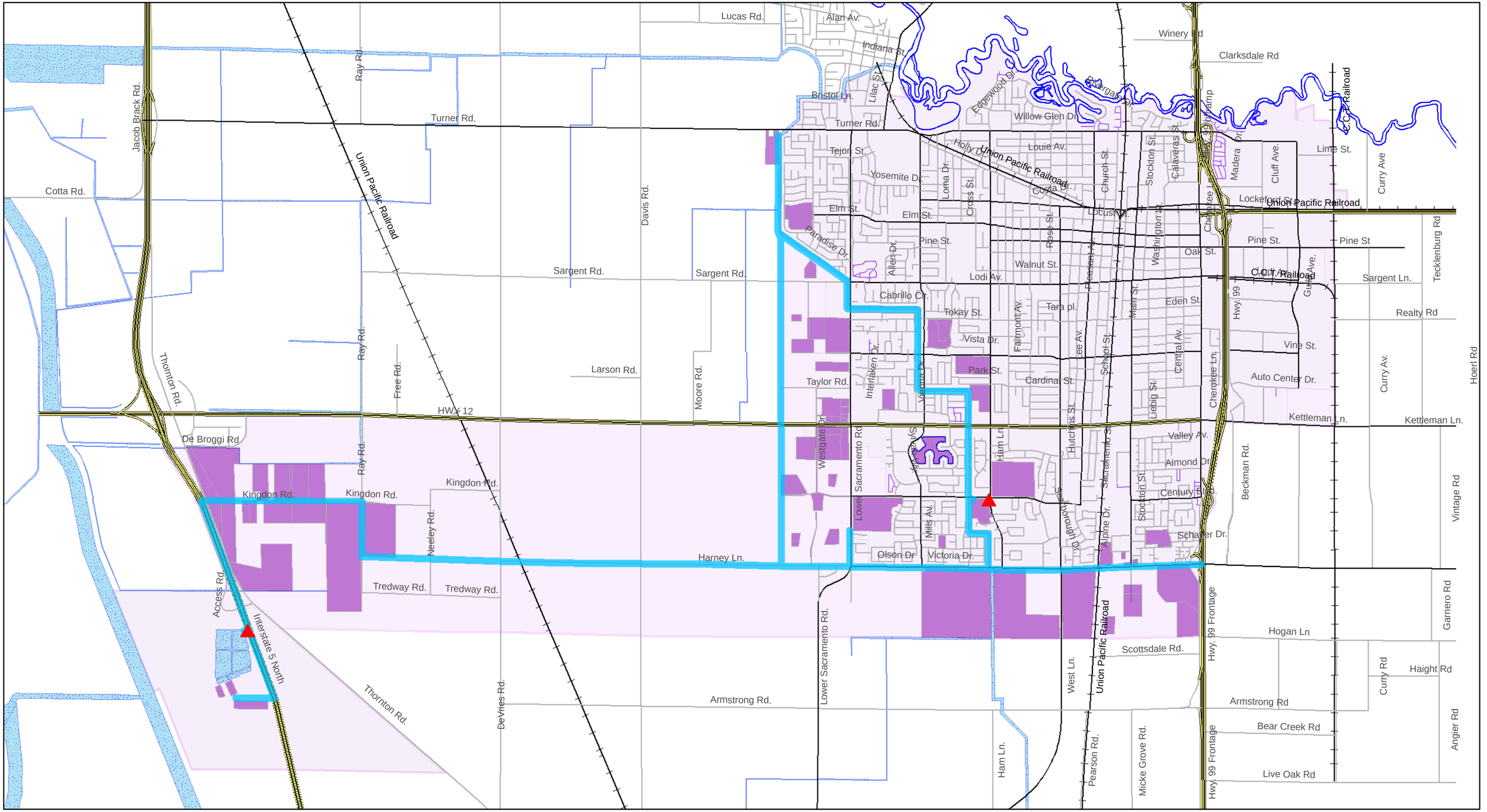
| Evaluation Criteria [a] | Description |
|---|---|
| Estimated Cost | Total cost per acre-foot of water delivered (capital cost to implement alternative and operational cost). |
| Flexibility | Ease with which (1) plans can be changed to address unforeseen circumstances including ability to alter the plan to account for changes in planning assumptions regarding future demand patterns, projected resources or other uncertainties, and (2) project can be phased. |
| Meet Project Goals | Ability to meet project objectives established in Section 1 of this TM. |
| Ease of Implementation | Ease with which alternative can be designed, permitted, and constructed. This also includes the ability to overcome obstacles (such as utility crossings). |
| Social Impacts | Various impacts including construction related impacts. |
| Regional Plan Adaptability | Degree of synergy with potential regional recycled water system. |
| Revenue Potential | Revenue that the City can expect to collect for this service for use of maintenance or funding of the project. |

Footnotes:
a. Environmental impacts, legal and regulatory issues, and technical feasibility were initially considered; however, these criteria do not significantly differentiate alternatives and were therefore not discussed further.

# 5 Conclusions

Each of the conceptual alternatives presented in this technical memorandum has been identified based on discussions with the City and the potential market of recycled users. These conceptual alternatives will be evaluated during the development of the Draft RWMP. In an effort to minimize the number for alignments to be evaluated while ensuring the selection of a minimum of two fundamental alternatives for a recycled water distribution system, a qualitative screening was conducted during the development of this TM. Following discussion with City staff, RMC recommends the City considers further refinement and evaluation of Alternative A and the looped version of Alternative D. Alternative A represents a looped, mixed agricultural and urban recycled water system, while the looped version of Alternative D provides a fundamentally different agriculture-only alternative. A preliminary comparison of the selected alternatives, using the evaluation criteria presented in Table 2, is presented in **Attachment A** to this TM.

The "No Project" Alternative will also be discussed in the Draft RWMP; however, this alternative is not considered preferable due to the need to offset the potable water supply and reduce wastewater discharge.




**Legend**

- City Limits
- RW Service Area
- Potential RW Customers
- Canal
- RW Distribution Main
- Pump Station

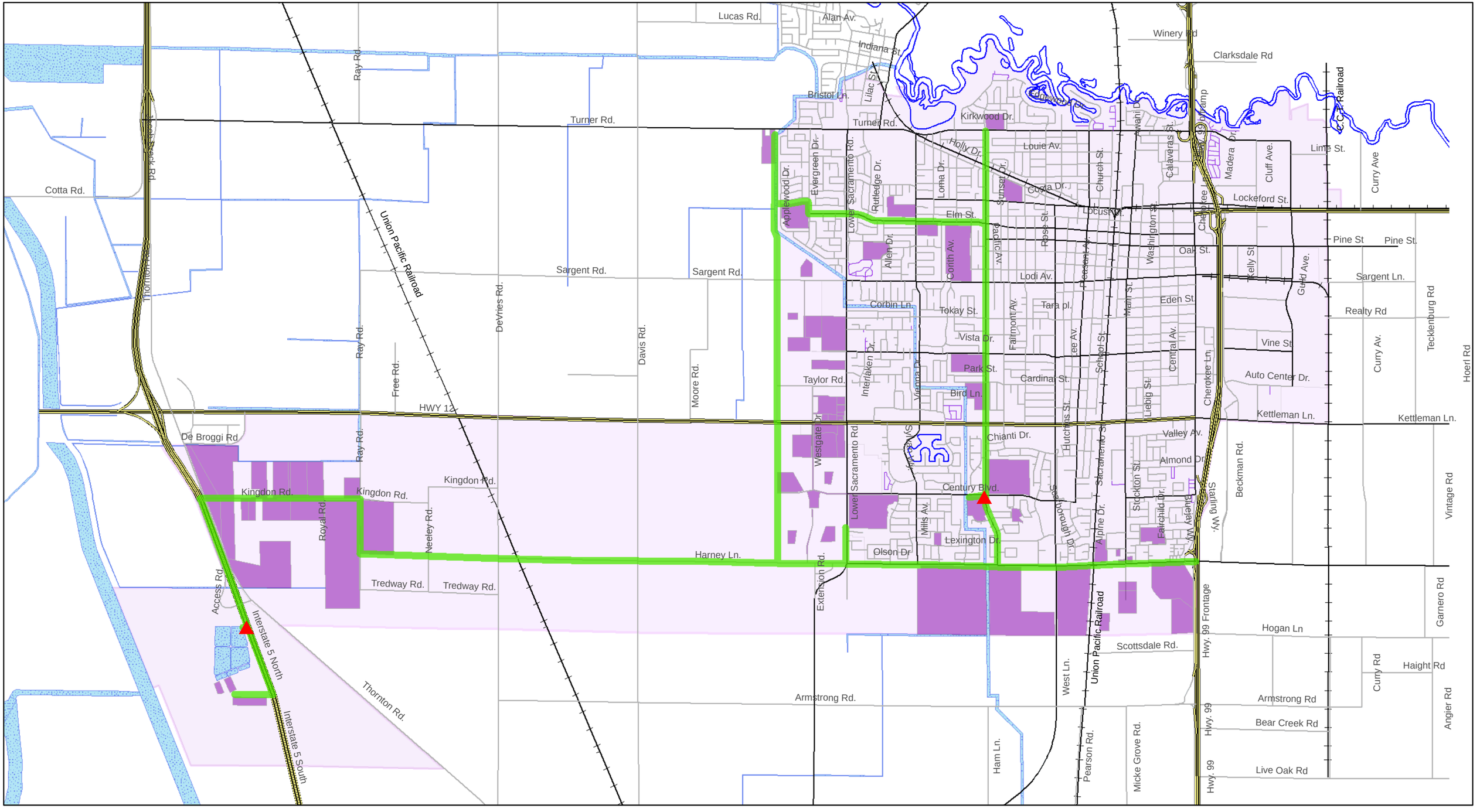
# City of Lodi Recycled Water Master Plan

## Figure 1 Alternative A

N W E S

0 0.25 0.5 1

Miles



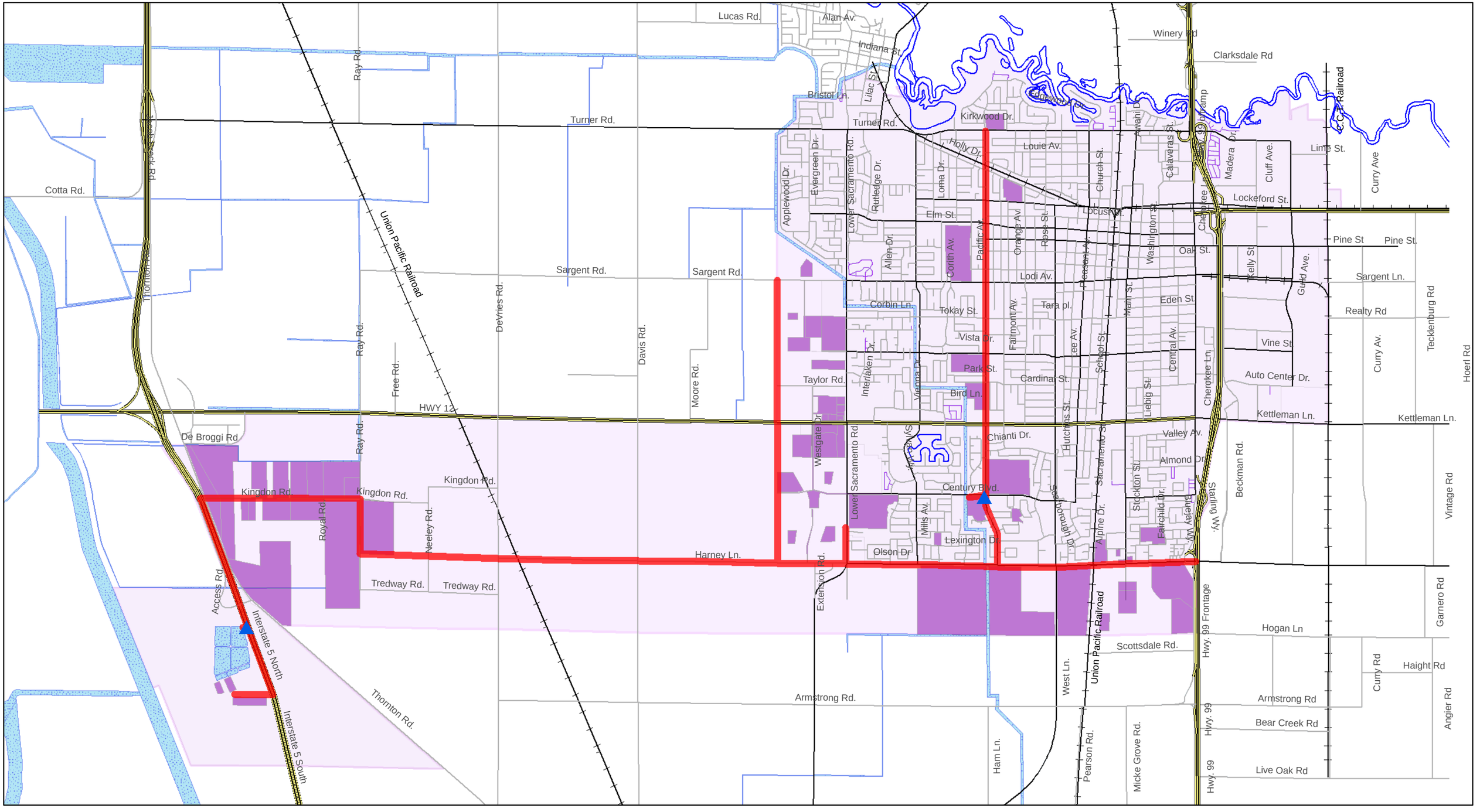

**Legend**

- City Limits
- RW Service Area
- Potential RW Customers
- Canal
- Pump Station
- RW Distribution Main

# City of Lodi Recycled Water Master Plan

## Figure 2 Alternative B

0 0.25 0.5 1 Miles




**Legend**

- City Limits
- RW Service Area
- Potential RW Customer
- Canal
- Pump Station
- RW Distribution Main

# City of Lodi Recycled Water Master Plan

## Figure 3 Alternative C

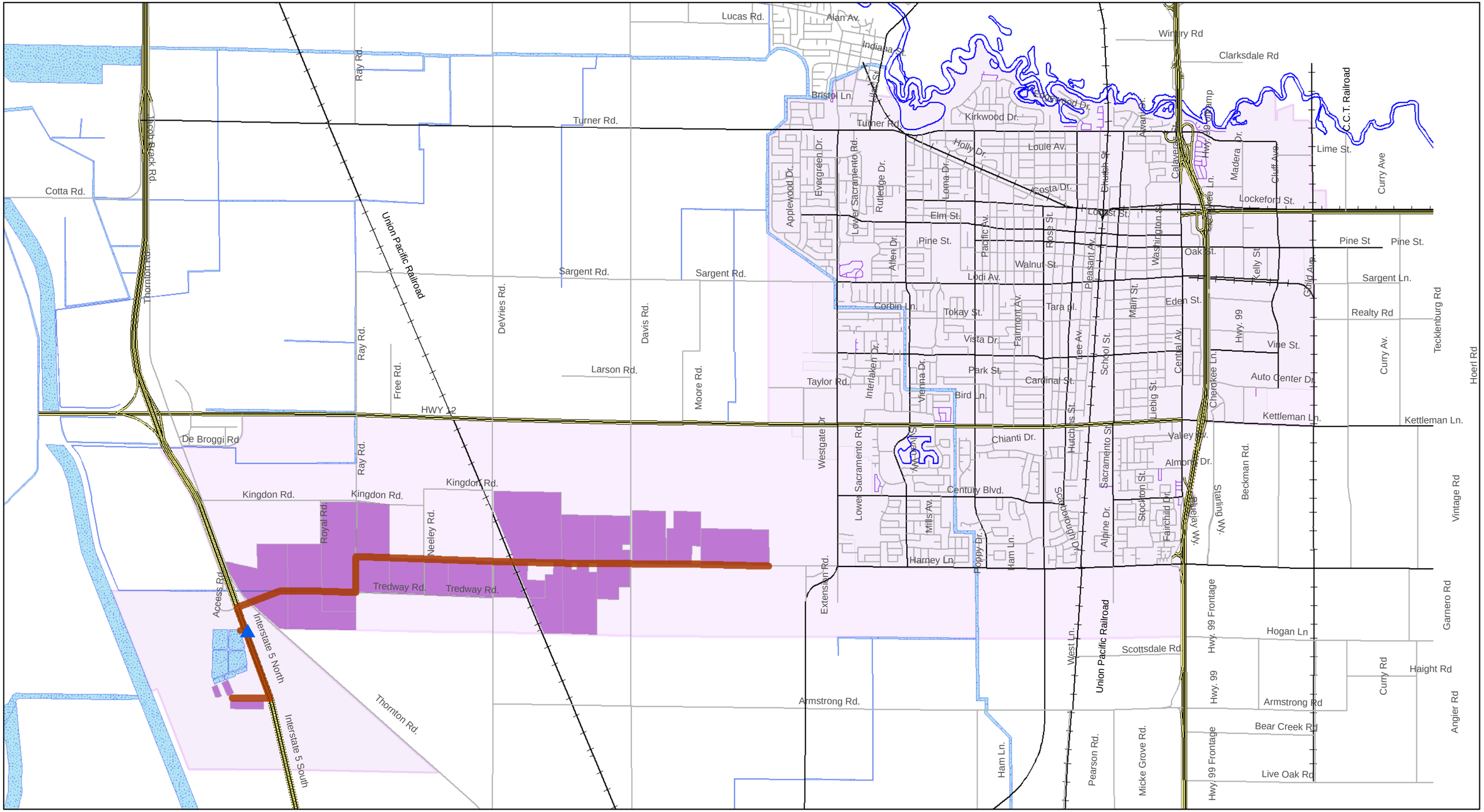
CITY OF LODI CALIFORNIA

RMC

N W E S

0 0.25 0.5 1

Miles




**Legend**

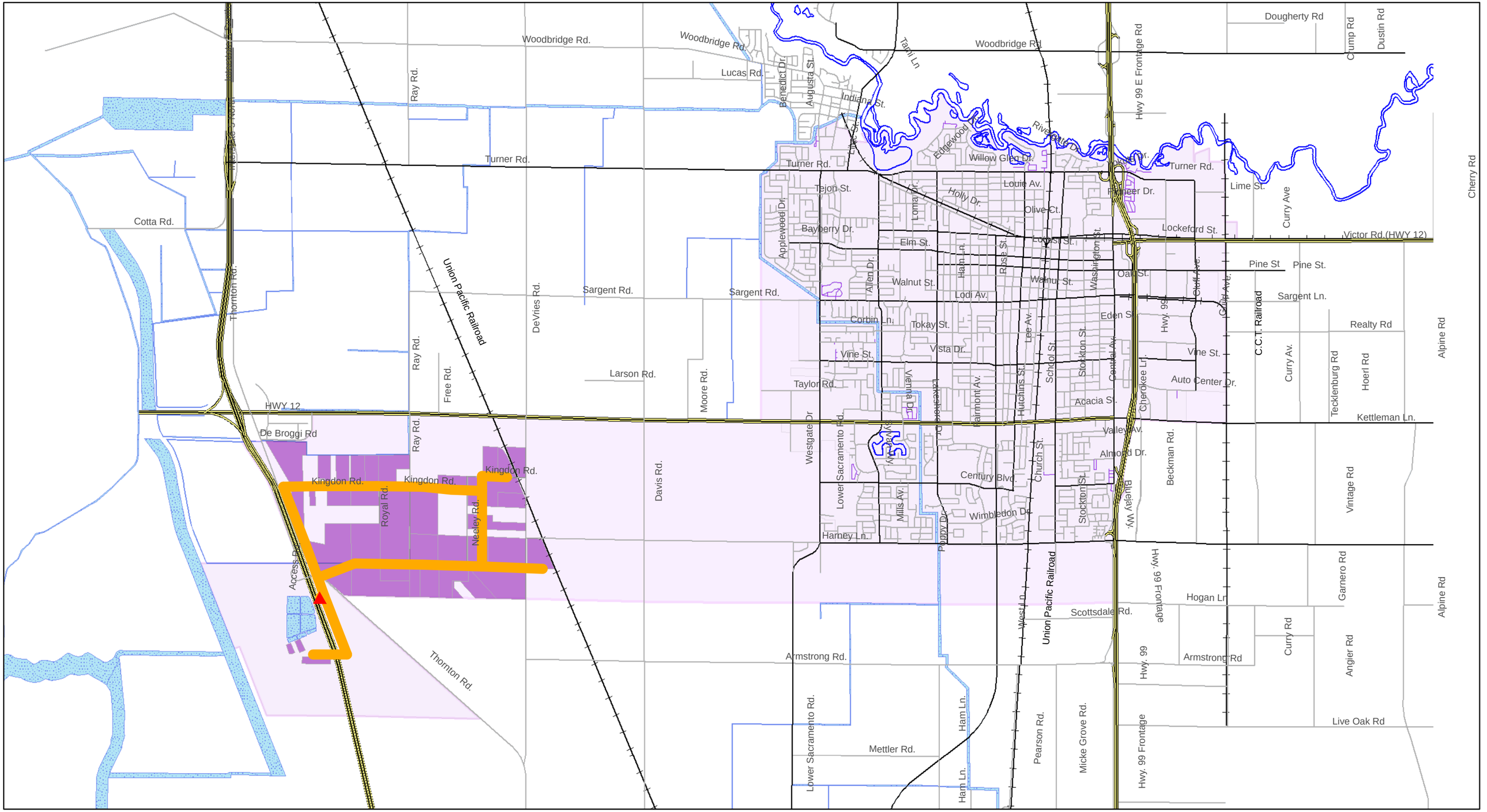
- City Limits
- RW Service Area
- Potential RW Customers
- Canal
- Pump Station
- RW Distribution Main

# City of Lodi Recycled Water Master Plan

## Figure 4
## Alternative D - Non-Looped

N
W E
S

0 0.25 0.5 1
Miles




**Legend**

- City Limits
- RW Service Area
- Potential RW Customers
- Canal
- Pump Station
- RW Distribution Main

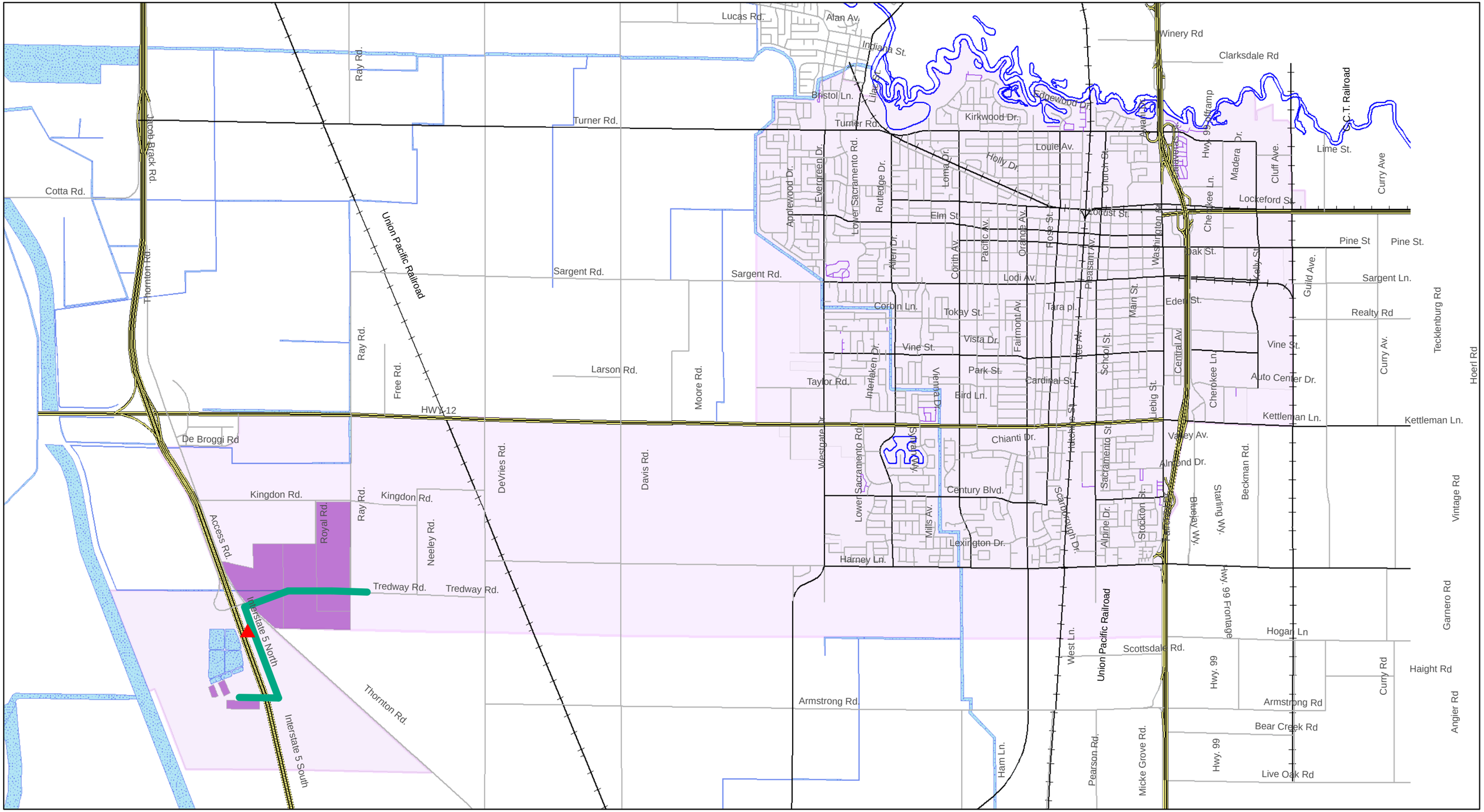
# City of Lodi Recycled Water Master Plan

## Figure 5
## Alternative D - Looped

N W E S

0 0.3 0.6 1.2

Miles




**Legend**

- City Limits
- RW Service Area
- Potential RW Customers
- Canal
- Pump Station
- RW Distribution Main

# City of Lodi Recycled Water Master Plan

# Figure 6 Alternative D (Peak Hour Demands)

N W E S

0 0.25 0.5 1

Miles

# Attachment A
# Preliminary Evaluation of Selected Alternatives

# City of Lodi

## Recycled Water Master Plan

**PRELIMINARY Conceptual Alternatives Evaluation**

| Evaluation Criteria | Description | Weighting Factor | Alternative A | | Alternative D | |
|---|---|---|---|---|---|---|
| | | | Score | Comment | Score | Comment |
| **Estimated Cost** | Total cost per acre-foot of water delivered (capital and operational cost) | 50% | 3 | Capital Cost: approx. $136 M<br>Unit Cost: approx. $2,400/AF | 1 | Capital Cost: approx. $66 M<br>Unit Cost: approx. $1,800/AF |
| **Flexibility** | Ability to change plans to address unforeseen circumstances, and project phasing capability | 25% | 2 | Project is limited to users along corridor<br>WCPF location limits flexibility | 2 | Project is limited to users along corridor<br>WCPF location limits flexibility |
| **Meet Project Goals** | Ability to meet project goals | 10% | 1 | Meets all project goals | 2 | Does not meet goal of using WID water as an iterim supply |
| **Ease of Implementation** | Ease with which alternative can be designed, permitted, and constructed | 5% | 2 | Citywide construction<br>Use of WID canal alignment reduces utility crossings and pavement disruption | 1 | Least amount of construction<br>Minimal cost to City<br>No trenchless crossings |
| **Social Impacts** | Various impacts including risk of impact to biological systems and construction related impacts | 5% | 2 | Some construction impacts | 1 | Least amount of construction limits impacts |
| **Regional Plan Adaptability** | Degree of synergy with potential regional recycled water system | 5% | 3 | Inability to incorporate a regional system | 2 | Inability to incorporate a regional system |
| **Revenue Potential** | Revenue that the City can expect to collect for this service for use of maintenance or funding of the project. | 0% | 1 | Unknown at this time | 1 | Unknown at this time |
| | | **Total Score:** | **2.45** | | **1.40** | |

Alternatives are scored from most favorable (1) to least favorable (3) depending on how well they meet each evaluation criteria

# Appendix D Public Outreach Materials

**CITY OF LODI - *Recycled Water Master Plan***

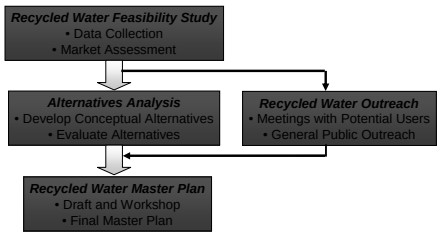
Workshop with Potential Recycled Water Users

***June 6, 2007***

***Presenters:***
***Deana L. Donohue, P.E.***
***Dave Richardson, P.E.***
***Andy Smith***

RMC

## *RWMP Project Approach*

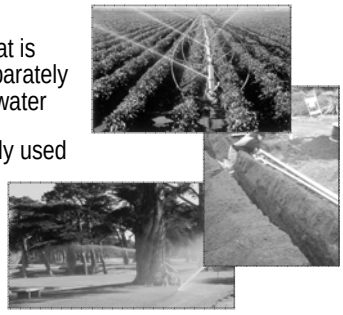



## *Goals and Objectives*

- Understand the quality and benefits of recycled water
- Present Project Concept to Potential Users
- Answer Questions on Project Concepts and Opportunities
- Obtain Feedback and Information from Users to help define the project

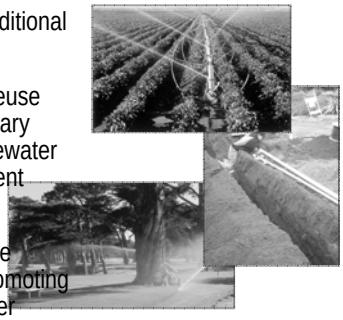
## *What is Recycled Water?*

- Highly treated wastewater that is distributed separately from drinking water
- Most commonly used for irrigation

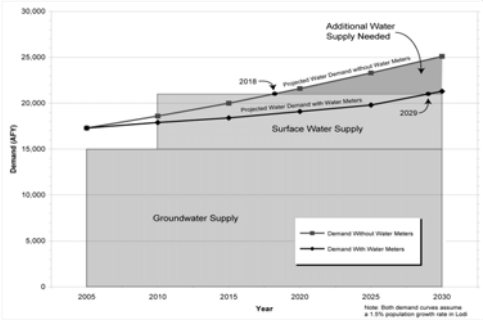


## *What are the Benefits of Recycled Water?*

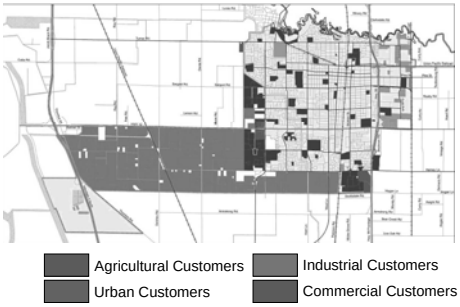
- Provide an Additional Water Supply
- Beneficially Reuse Available Tertiary Treated Wastewater (Reduce Effluent Discharge)
- Align with State Guidelines Promoting Recycled Water



## *The Need for Recycled Water in Lodi*



## *Potential Recycled Water Market*




## *Water Quantity*

- Quantity available
  - White Slough WPCF Supply:
    - 6,900 – 9,500 Acre Feet per Year (AFY)
  - WID Surface Water Delivery:
    - 6,000 AFY Contracted (March 1 to October 15)
    - 2,400 AF (~500 AFY) Banked

## *Water Quality*

- Quality suitable for a variety of irrigation purposes
  - Salinity (Total Dissolved Solids- TDS)
  - Sodium (Sodium Adsorption Rate-SAR)
  - Toxicity
    - pH
    - Chloride
    - Nitrogen
    - Potassium

## *Crop-Specific Quality & Quantity Issues*

- Varying irrigation practices:
  - Most irrigate based on crop, soil type, and weather
  - Many growers using drip irrigation
- Many growers using good quality surface and/or well water
  - 200 mg/L TDS or lower
- Potential concerns:
  - Level of treatment (e.g., pathogens)
  - Filtration prior to drip irrigation
  - TDS and nitrogen content

## *Conceptual Alternative 1*

## *Conceptual Alternative 2*

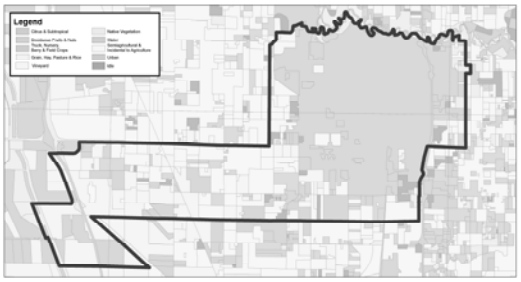
## *Conceptual Alternative 3*

## *Goals and Objectives*

- Understand the quality and benefits of recycled water
- Present Project Concept to Potential Users
- Answer Questions on Project Concepts and Opportunities
- Obtain Feedback and Information from potential Users to help define the project

## *Questions/Comments*

## *Crop Types in the Lodi Area*




*Source: 1996 DWR Land Use Survey*

**Projected Recycled Water Quality vs. Interpretive Guidelines for Water Quality for Irrigation**

| Representative Water Quality Objectives for Irrigation[1] | | | | | | White Slough WPCF Effluent Water Quality | Predicted Future Recycled Water Quality |
|---|---|---|---|---|---|---|---|
| **Potential Customer Concern** | **Related Constituents** | **Units** | **Good** | **Fair** | **Poor** | | |
| Sprinkler Plugging | TSS | mg/L | No specific guidelines; less than 5 mg/L desirable | | | 3 | 3 |
| | Turbidity | NTU | No specific guidelines; less than 2 NTU desirable | | | <2 | <2 |
| Plant Salt Tolerance | TDS | mg/L | < 450 | 450 – 2,000 | > 2,000 | 377 | 245 |
| Soil Permeability | Adjusted Sodium Adsorption Ratio (SAR) | SAR ratio | < 6.0 | 6.0 – 9.0 | > 9.0 | 4 | 3.9 |
| Ion Toxicity to Plant Foliage or Root (Sprinkler)[2] | Sodium | mg/L | < 70 | > 70 | - | 73 | 47.4 |
| | Chloride | mg/L | < 100 | > 100 | - | 73 | 41 |
| | Boron | mg/L | < 0.5 | 0.5 – 1.0 | >10 | 0.2 | 0 |
| Miscellaneous | Bicarbonate (Sprinkler) | mg/L | <90 | 90-500 | >500 | 188 | 122 |
| | pH | pH unit | Normal range: 6.5 – 8.4 | | | 7.0 (range 6.2 – 8.0) | 6.9 |

1. After Pettygrove and Asano, 1985; does not consider differences in tolerance among plant species, irrigation frequency, or specific site conditions such as soil texture, drainage, and chemical characteristics.
2. Plant Sensitivity to specific ions varies widely by plant species and irrigation method.

# Meeting Minutes

**City of Lodi Recycled Water Master Plan**

**Subject:** Large Users Workshop - Ag
**Prepared By:** Andy Smith
**Date/Time:** June 6, 2007 / 1:00 p.m.
**Location:** Lodi
**Project Number:** 0140-003

## Attendance:

- Lyman Chang, Chris Boyer, Wally Sandelin, Richard Prima (Lodi)
- Deana Donohue, Dave Richardson, Andy Smith (RMC)
- Barbara Butterworth, Rick Grewal, Gregg Meath, George Marion, Ray Coldani, John Cosisi (Public Attendees)

## Meeting Objectives:

- Present project concepts to potential users
- Answer questions on project concepts and opportunities
- Obtain feedback and information from users to help define the project

## Questions & Comments:

| Question/Comment | Answer/Response |
|---|---|
| 1. Would the RW be distributed via a pipeline? (versus a canal?) | Yes, there would be a pressure pipeline from the White Slough WPCF. |
| 2. How would water get from the pipeline to a property that may be some distance away? | Additional pipe would be required (e.g., a lateral); we don't yet know where these laterals would be located (location would be based on interest), and we don't yet know who would be responsible for the costs. |
| 3. What happens if RW contaminates the underlying GW? | The City would retain a certain amount of liability for cases such as these. Here's how the process would work:<br>a. Conduct the RW feasibility study<br>b. Define project(s) according to results of feasibility study<br>c. The defined project would then go through CEQA<br>d. If the project gets the OK (i.e., no non-mitigatable impacts), the City will then need use agreements with each customer. Limited liability would remain with the City. |
| 4. What about areas outside the recycled water service area? Have they been considered as potential customers? | We had to take a realistic approach to looking for customers. There is likely more demand than supply, so the service area was defined to include the City limits and an area near a potential alignment between the treatment plant and the main City limits. |
| 5. What if my neighbor uses RW? Will it contaminate my GW? | |
| 6. The process for determining liability would be adversarial (i.e., plaintiff's would need attorney) | |

| Question/Comment | Answer/Response |
|---|---|
| 7. Does the City plan to deal with nitrate loading problems [near the White Slough plant]? A study has said that we simply need to expand the land application area. | There are currently three (3) sources of nitrate in the area near the White Slough plant, and the City is currently constructing an upgrade to the plant that will provide a solution for the WW source.<br><br>For other sources of nitrate (biosolids and cannery waste), solutions are being considered, and will be implemented in the future, but we're not sure how and when at this point. |
| 8. The airport [east of the White Slough plant] is sensitive to wildlife accumulating near the airstrip. Will there be any new ponding requirements as a result of the proposed RW system? | There is a potential for new ponds.<br><br>[When asked if there was any preference, on the airport's behalf, between "mucky" areas with standing water or deep ponds, the workshop attendee stated that they are essentially the same from a waterfowl standpoint.] |
| 9. Nitrate is a big issue; can we "trust" that the City will do what it says (i.e., consistently meet the State-required effluent limits)? | An upgrade to the White Slough plant that will reduce nitrates in the effluent is under construction; effluent should consistently meet nitrate requirements once the upgrade is up and running. |
| 10. This is a water supply project, right? | Yes, the water is valuable. The City is also conducting a joint RW planning study with Stockton at this time, and the City fully anticipates that Stockton will find a use for all of the available RW; |
| 11. One of the meeting attendees stated that he has 15 wells, and every one has been condemned (following recent testing); there is now an issue of whether he can sell his produce. He has hired an attorney. He stated that he can "live with the water" for personal consumption. He also stated that he could "probably use all the available RW." | |
| 12. The area north of the recycled water service area is mostly in WID boundaries. | |
| 13. What about the cost of RW? | We don't yet know what the costs for the water will be. It would probably be a lot cheaper to use the RW nearer to the plant than in City. |

| Question/Comment | Answer/Response |
|---|---|
| 14. WID has a "ground replenishment/recharge" fee; users pay a per-acre fee for GW recharge (meaning they pay for water they aren't using). | |
| 15. How will you pressurize the RW? What are the associated costs? | The City would build a pump station. The cost of such a pump station does not look daunting based on preliminary investigations. |
| 16. What's in the works for the area east of 1-5 (in the City-owned acreage surrounding the treatment plant)? Is wastewater effluent currently applied there? | The area is used for growing crops.<br><br>All but about 90 acres of that area is irrigated with effluent from White Slough. |
| 17. When did city begin applying effluent in that area? | In the 1950's (at that time the City's WWTP was located within the City, and treated effluent was sent to the users by pipeline); the White Slough plant was built in 1966. |
| 18. FAA regulations state that it's "illegal to do what the City is proposing (i.e., using RW to irrigate), because it attracts birds."<br><br>The airport's approach pattern is from the west, about 800 feet above ground – this means that any birds pose a serious threat.<br><br>According to the FAA regulations, birds prefer to land (even in fields) where "waste disposal" takes place.<br><br>A 10,000 ft perimeter (inside which no "waste disposal" or ponds may be located) is needed around airport. | There might be some chlorine residual in the RW pipe. This may make the water seem less "favorable" to waterfowl.<br><br>This would be a water reuse operation, rather than a waste disposal operation.<br><br>We'll look into the FAA regulations to verify that any project that is developed is not in violation. |
| 19. Same attendee from comment No. 11 uses between 30,000 and 50,000 gpm near White Slough (on his ~700 acres). He's growing olives, tomatoes, peppers, and probably others. | |
| 20. WID "replenishment/recharge" fee, for one meeting attendee: For their 30 irrigated acres, the GW recharge fee is $80/yr. | |

## Action Items:

1. Look into and verify FAA regulations; determine whether conceptual alternatives would violate any regulations. Also determine if and where it is stated that land irrigated with recycled water is more attractive to fowl than land irrigated with groundwater or surface water.

**CITY OF LODI - *Recycled Water Master Plan***

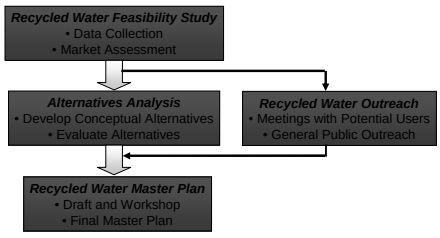
Workshop with Potential Recycled Water Users

***June 11, 2007***

***Presenters:***
***Deana L. Donohue, P.E.***
***Andy Smith***

RMC

## *RWMP Project Approach*

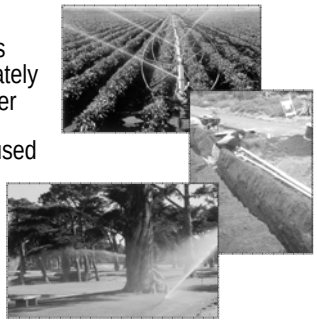



## *Goals and Objectives*

- Understand the Quality and Benefits of Recycled Water
- Present Project Concept to Potential Users
- Answer Questions on Project Concepts and Opportunities
- Obtain Feedback and Information from Potential Users to help define the project

## *What is Recycled Water?*

- Highly treated wastewater that is distributed separately from drinking water
- Most commonly used for irrigation and industrial applications



## *What are the Benefits of Recycled Water?*

- Provide an additional, drought-proof, and reliable long-term water supply
- Offset use of potable water supplies by beneficially re-using available tertiary treated wastewater
- Reduce effluent discharge
- Align with State guidelines promoting recycled water


## *The Need for Recycled Water in Lodi*

- The City of Lodi will need to bring a new water supply to its customers by 2020
- The best new supply available is Recycled Water

## *Potential Recycled Water Market*

Agricultural Customers
Industrial Customers
Urban Customers
Commercial Customers

## *Water Quantity*

- Quantity available
  - White Slough WPCF Supply:
    - 6,900 – 9,500 Acre Feet per Year (AFY)
  - WID Surface Water Delivery:
    - 6,000 AFY Contracted (March 1 to October 15)
    - 2,400 AF (~500 AFY) Banked

## *Water Quality*

- Quality suitable for a variety of applications
  - Irrigation:
    - Salinity (Total Dissolved Solids - TDS)
    - Sodium (Sodium Adsorption Rate - SAR)
    - Toxicity
      - pH
      - Chloride
      - Nitrogen
      - Potassium

## *Water Quality*

- Industrial Applications:
  - Calcium
  - Alkalinity
  - Silica
  - TDS
  - Chloride
  - Iron
  - Manganese

## *Operational Issues & Concerns*

- Retrofitting
- Storage
- Irrigation Periods
- Water Pressure
- Filtration (prior to drip irrigation)

## *Conceptual Alternative 1*

## *Conceptual Alternative 2*

## *Conceptual Alternative 3*

## *Goals and Objectives*

- Understand the quality and benefits of recycled water
- Present Project Concept to Potential Users
- Answer Questions on Project Concepts and Opportunities
- Obtain Feedback and Information from potential Users to help define the project

*Questions/Comments*

## Projected Recycled Water Quality for Industrial Applications

| Constituents of Concern | Units | White Slough WPCF Effluent Water Quality | Predicted Future Recycled Water Quality[1] | |
|---|---|---|---|---|
| pH | pH units | **7.0** (range 6.2 – 8.0) | *6.9* | No expected change |
| Alkalinity | mg/L as $CaCO_3$ | **153** (range 120 – 230) | *99* | Estimated based on mass balance |
| Total Suspended Solids | mg/L | **3** (range 0.1 – 22) | *3* | No expected change |
| Total Dissolved Solids | mg/L | **377** (range 150 – 540) | *245* | Reduction in source TDS |
| Ammonia | mg/L | **2** (range 0.03 – 25) | *2* | No expected change |
| Silica | mg/L | **69** (range 65 – 72) | *69* | No expected change |
| Chloride | mg/L | **64** (range 55 – 77) | *41* | Reduction in source chloride |
| Manganese | µg/L | **27.6** (range 11.7 – 41.6) | *27.6* | No expected change |
| Aluminum | µg/L | **35** (range non-detect – 40) | *28* | Reduction in Source Aluminum |
| Calcium | mg/L | **29** (range 22 – 34) | *19* | Reduction in source hardness |
| Zinc | µg/L | **33.9** (range 2.5 – 69) | *24* | reduction in source zinc |
| Copper | µg/L | **3** (range non-detect – 13) | *3* | No expected change |
| Iron | mg/L | **100** (range 100 – 200) | *94* | reduction in source iron |

[1] Estimated values are italicized. For the purposes of this analysis, it was assumed that recycled water quality concentrations will change in proportion to the change in drinking water parameter concentrations resulting from blending groundwater and surface water supplies.

# Meeting Minutes

**City of Lodi Recycled Water Master Plan**

**Subject:** Large Users Workshop - Urban
**Prepared By:** Andy Smith
**Date/Time:** June 11, 2007 / 1:00 p.m.
**Location:** Lodi
**Project Number:** 0140-003

## Attendance:

- Lyman Chang, Chris Boyer, Richard Prima (Lodi)
- Deana Donohue, Andy Smith (RMC)
- Steve Virrey, Tim McGeorge (Lodi Parks Division)

## Meeting Objectives:

- Present project concepts to potential users
- Answer questions on project concepts and opportunities
- Obtain feedback and information from users to help define the project

## Questions & Comments:

| Question/Comment | Answer/Response |
|---|---|
| 1. Are specialized pumps required for use with RW? The Parks Division has quite a few older booster pumps. | We don't anticipate any special pump requirements, but there are certainly specialized equipment/materials (e.g., impellers, pump casings, etc.) available if necessary. |
| 2. The Parks Division has not yet spoken with parks staff from other municipalities using RW. RW holding ponds are under construction in Manteca. Parks Division intends to discuss RW operational issues at upcoming interagency workshops/meetings. | Suggested contacts: City of Roseville (incl. golf course managers), City of Pittsburg (also incl. municipally-owned golf course), Elk Grove, El Dorado Hills |
| 3. Would basket strainers be required for filtering RW upstream of irrigation valves? | Possibly; strainers and other retrofits will be evaluated during the evaluation of the chosen alternative. RW from White Slough would not require additional filtration/straining, but some form of straining will likely be necessary if raw WID water is drawn from the canal. Strainers could be located at the raw water intake, rather than at the points of service. |
| 4. There was a recent article about fruit stickers getting all the way through the wastewater treatment process. Could this be a problem for Lodi (i.e., could the stickers get into the RW system and clog irrigation valves)? | Probably not. It is unlikely that fruit stickers would pass the cloth filters currently in use at White Slough. |
| 5. What other types of retrofits/requirements might be necessary if the Parks Division accepts RW? | Title 22 includes requirements for backflow prevention devices; overspray, misting, and runoff; color coding of RW pipes; signage; and quick coupling connections. These requirements will be considered and discussed during the evaluation of alternatives. |
| 6. Richard: The price of RW would be different than the current price for potable GW. (The difference would benefit the Parks Division). | |
| 7. Lyman: Are there water meters at all of the parks? | Yes. |
| 8. The peak day peaking factors for the City's parks appears high (in comparison to typical values in California). | Every park is different. Particularly for parks with frequent athletic use, irrigation schedules can be tricky, often requiring more water to be applied at one time. |

| Question/Comment | Answer/Response |
|---|---|
| 9. The presence and/or configuration of RW booster pumps will impact the Parks Division's ability to control irrigation periods – with higher pressures, more valves can be operated simultaneously. [Pixley Park?] occupies 26 acres, and has about 65 valves.<br><br>The presence of sloped sides in basin parks also affects irrigation periods – these parks need alternating cycles to avoid excessive runoff towards the toe of the slope. | |
| 10. A number of the City's parks are on Maxicom irrigation control systems. | Can RMC obtain a list of all of the parks controlled by Maxicom? |
| Four or five of the City's parks are on ET-based irrigation schedules – these don't always work with athletic facilities. | We will need the irrigation system printouts for all parks in order to help size storage at White Slough and/or in the distribution system. |
| 11. The Parks Division has been aware that RW has been in the works for some time, and is prepared to accept it. | |
| 12. The school district has a $25,000 weather station, which it had intended to use for a different irrigation management system, still sitting in a box. | |
| 13. What does the Parks Division's weather station measure? | Temperature, wind run, humidity, solar (?), and rainfall. A technician cleans and recalibrates the equipment annually. The Parks Division has compared data from its weather station to that of the Fire Department, and found the FD's rainfall data to be higher by 3-5 inches (for the 2006-2007 water year). |
| 14. Richard: The CIMIS station located west of Lodi may not be a reliable source for controlling park irrigation (although the average precipitation values are probably very close). | |
| 15. Lyman: A representative from the Lodi Academy called to inquire about recycled water and its implications on a school site. | |

## Action Items:

1. Tim McGeorge will provide a list of the City's parks that currently feature Maxicom irrigation systems (sent 6/12/07).
2. Contact hoped-for workshop attendees that did not attend: Jack Merrill from Mainland Nursery; Art Hand (sp?) from the school district, etc. We may need to send them the workshop materials prior to having a phone discussion.
3. The City had trouble printing the draft Market Assessment TM. RMC will provide a PDF that does not contain 11x17 pages.
4. RMC and the City will conduct a workshop debrief within the next week or so to go over the feedback from workshop attendees, and to discuss a systematic approach to paring down the list of potential users, in conjunction with the refinement of conceptual alternatives for the next phase of the project.

# Appendix E City of Lodi Annual Water Quality Report for 2006

# City of Lodi
# Annual Water Quality Report for 2006

(published April 2007)

**Keeping you, the Citizens of Lodi, informed about your drinking water.**

**Este informe contiene información muy importante sobre su agua potable. Tradúzcalo ó hable con alguien que lo entienda bien. Para la ayuda en español, llama por favor (209) 333-6740.**

This 18th Annual Water Quality Report summarizes testing on Lodi's water supply by State certified laboratories and provides information about the water system. This report follows the "Consumer Confidence Report" (CCR) format required by the U.S. Environmental Protection Agency and the State of California.

## WHO ARE WE?

In 1910 your City of Lodi Water Utility officially began operation along with the Electric Utility, and for 96 years, the water system has been owned by the Citizens of Lodi. Ninety-six years ago there were only two wells and a few miles of water mains. In 2006 there were twenty-six wells, over 220 miles of mains, a water tower and a 1-million-gallon storage tank. Lodi delivers water to approximately 23,000 residential, commercial and industrial customers.

Water rates, system expansion projects, and significant purchases are authorized by the Lodi City Council, which serves as the water utility's official regulatory body. **Lodi City Council meetings are open to the public and are scheduled for the first and third Wednesdays of each month at 305 West Pine Street in Lodi at 7:00 p.m.** You may also communicate with the Council and City staff through the City's web site (www.lodi.gov).

## YOUR DRINKING WATER SYSTEM

Twenty-six computer controlled wells, located throughout the City, provide high quality groundwater, and was our sole source of supply in 2006. The wells operate automatically on water pressure demand so that when water use increases, more wells are started. To keep up with peak water supply demands, a new well is planned for 2007. The costs of new wells are paid by development fees. However, the groundwater basin is being depleted. Lodi has contracted to use some surface water from the Mokelumne River. The City has begun studies to treat this water and use it directly, thereby reducing groundwater pumping. More information on water supply is on the City's web site.

Seven wells are fitted with emergency diesel-powered generators. (While these generators will help maintain water pressure during power outages, please refrain from using water during power outages to save capacity for essential uses, - hospitals, fire fighting, etc.)

The water delivered to your tap meets or is better than all federal and state water quality standards.

**If you have any questions about this report or Lodi's water quality, please contact:**

**Water/Wastewater Superintendent**
**Frank Beeler**
**1331 S. Ham Lane, Lodi, CA 95242**
**Telephone: (209) 333-6740**
**E-mail: fbeeler@lodi.gov**

## WATER QUALITY

Lodi is fortunate in having a high quality groundwater supply. However, that supply is at risk and must be carefully managed. The following section describes some of these measures.

**- PCE/TCE -** The City, working with regulatory agencies and potentially responsible parties in a cooperative manner, is pursuing a resolution to a groundwater contamination problem in the north and central Lodi area. While no operating wells are out of compliance with any drinking water standards, the contamination is a serious threat. PCE (Tetrachloroethylene) and TCE (Trichloroethylene) have been detected in samples taken in soils and groundwater. Cleanup work in portions of the area has commenced and the City expects additional areas to commence cleanup work in 2007/08. The City's share of these costs has largely been determined and a series of rate adjustments has been adopted. More information on this can be found on the City's website.

**- Bacteriological Quality, Chlorination -** Lodi takes over 20 samples per week from throughout Lodi's water distribution system for bacterial water quality. Regulations allow for 5% of all total coliform samples in a month to be positive. In 2006 all bacteriological standards were met.

The water may be periodically chlorinated as a proactive step to help keep the water system in compliance with strict bacteriological standards; however, Lodi's water does not normally contain chlorine. The City will make an effort to inform you in local newspapers before your water is chlorinated. When necessary however, the water may be chlorinated before you can be informed.

**- MTBE -** MTBE (Methyl-Tert-Butyl-Ether) is a controversial additive to gasoline that has been in the news the past few years. One of the main concerns with MTBE is the threat of leaking from service stations into the groundwater. Monitoring of City wells has NOT found any detected traces of MTBE to date. The City has a program of monitoring all City wells for MTBE. Wells that are at greater risk (i.e., closer to gasoline stations) are monitored more frequently.

**- DBCP -** Dibromochloropropane (DBCP) was used by area farmers to kill nematodes in vineyards. DBCP was banned in California in 1977, but is still present in trace levels in some groundwater. The City of Lodi used 25 (of 26) wells to provide drinking water in 2006. The wells are rotated so over the course of time, water being delivered is a blend from these wells. Thirteen of Lodi's wells had no detectable DBCP. Six wells have filters to remove DBCP. The remaining six meet State and Federal standards, but have trace amounts of DBCP. The result is that the people of Lodi are being served water below the DBCP level deemed safe by the U.S. EPA and the State of California.

In 1996 the City settled a lawsuit against DBCP manufacturers, who have already paid the City for a large portion of Lodi's costs related to DBCP treatment. These manufacturers will continue to pay a large portion of the City's DBCP related costs for the settlement's 40-year term.

**- Drinking Water Source Assessment -** An assessment of the drinking water sources for the City of Lodi's water system was completed in February 2003. The sources are considered most vulnerable to the following activities: gas stations (current and historic), chemical/petroleum processing/storage, metal plating/ finishing/fabricating, plastic/synthetics producers, dry cleaners, known contaminant plumes, sewer collection systems, fleet/truck/bus terminals, machine shops, utility stations-maintenance areas, agricultural drainage, and photo processing/printing.

A copy of the completed assessment is available at the Public Works Department, City of Lodi, 1331 South Ham Lane, Lodi, CA 95242. You may request that a copy be sent to you by contacting Frank Beeler at (209) 333-6740. A copy of the complete assessment is also available at the Department of Health Services, Drinking Water Field Operations Branch, Stockton District Office, 31 E Channel Street, Room 270, Stockton, California 95202. You may also request that a copy be sent to you by contacting Joseph O. Spano, District Engineer, at (209) 948-7696

## IF YOU HAVE A WATER PROBLEM

-Many times, water quality problems in the home can be traced to the hot water heater, the plastic water lines under the sink to faucets, or because sewer gases from the drain are being smelled.

-Set the hot water heater at the proper temperature, too hot can create heavier scaling problems, and not warm enough can allow bacteria to grow.

-Other times there can be occasional water quality problems associated with the aesthetic quality of your water such as sand, which may be originating from water supply mains.

-"Hard" water can be considered a quality issue depending on the actual hardness level and the use. Some industrial processes require very soft water. Lodi's groundwater is at the low end of the "moderately hard" water range and you may see white scale or spots on plumbing fixtures.

-If you have a filter or in-home treatment system; be sure it's working properly and change filters regularly. (Note, if you use a water softener, we suggest you utilize one which is regenerated by the softener company. Self-regenerating units add salt to the wastewater, which can add significantly to the City's wastewater treatment costs.)

-Low pressure can lead to water quality problems and can be caused by plugged screens in faucets or washing machine hoses, broken valves or for other reasons. If you have intermittent problems, first check pressure in other parts of your house or at an outside faucet. If that pressure is okay, check the fixture/screens at the problem area. If the problem is throughout the whole house, call the City for assistance.

**If you ever experience trouble with your water, and you do not think it is a problem with your on-site plumbing, please call the Water/Wastewater Division at 368-5735 or 333-6740.**

## WATER CONSERVATION

In 2006, 5.313 billion gallons of groundwater were pumped to meet Lodi's water demands. This is 26% less water use per person than in 1986. As population in Lodi and California increases, water conservation becomes an important part of meeting demands for fresh water.

The commitment of the citizens of Lodi to conserving water also helps conserve the electrical energy needed to pump the water to homes and businesses. To further conserve water, electrical energy, and wastewater treatment plant capacity, the City has instituted a rebate program for water saving devices such as low-flow toilets. See details below.

Your diligent water conservation practices, as in the past, are needed in 2007. A report calculated dollar savings from water conservation to be far above the cost of the Water Conservation Program! Your water conservation efforts have also averted millions of dollars in capital costs, helping rates stay as low as possible. The millions of dollars in capital cost savings can easily be lost if water conservation is not continued.

See the summary of the Lodi Water Conservation Ordinance at: http://www.lodi.gov/public%5Fworks/water%5Fconservation.html For information or to report a water waste, call the Water Conservation office at 333-6829.

## $ Water Conservation Rebate Program $

The City of Lodi is offering rebates on the purchase and installation of water conserving devices at residential and commercial water customer premises within the City of Lodi.

Rebates of up to $44 are given for Ultra Low-Flow Toilets rated at 1.6 gallons per flush or less and must be replacing units using a higher volume of water per flush. Rebates of up to $100 are available for pressure assist PF/2 Ultra Low-Flow 1.6 gallon toilets. Additional rebates of 50% are available on Low-Flow Shower Heads, Insulated Hot Water Blankets, and Hose Bib Manual Timers for outside water hoses.

The program is funded by the Water, Wastewater and Electric Utilities. **The rebates, given in the store at the time of purchase, are only available at the following Lodi stores:**

**Ace Hardware** • 827 West Kettleman Lane
**Orchard Super Hardware** • 360 South Cherokee Lane
**Ferguson Enterprises, Inc** • 1435 Academy Street

Call (209) 333-6740 for more details.

**THE FOLLOWING MESSAGES ARE REQUIRED BY THE U.S. EPA AND THE STATE OF CALIFORNIA. NOT ALL PORTIONS OF THESE MESSAGES NECESSARILY APPLY TO LODI'S GROUNDWATER .**

• Drinking water, including bottled water, may reasonably be expected to contain at least small amounts of some contaminants. The presence of contaminants does not necessarily indicate that water poses a health risk. More information about contaminants and potential health effects can be obtained by calling the USEPA's Safe Drinking Water Hotline at (1-800-426-4791).

• Some people may be more vulnerable to contaminants in drinking water than the general population. Immuno-compromised persons such as persons with cancer undergoing chemotherapy, persons who have undergone organ transplants, people with HIV/AIDS or other immune system disorders, some elderly, and infants can be particularly at risk from infections. These people should seek advice about drinking water from their health care providers. USEPA/Centers for Disease Control (CDC) guidelines on appropriate means to lesson the risk of infection by Cryptosporidium and other microbial contaminants are available from the Safe Drinking Water Hotline (1-800-426-4791).

• The sources of drinking water (both tap water and bottled water) include rivers, lakes, streams, ponds, reservoirs, springs, and wells. As water travels over the surface of the land or through the ground, it dissolves naturally occurring minerals and, in some cases, radioactive material, and can pick up substances resulting from the presence of animals or from human activity.

• Contaminants that may be present in source water include:

  • Microbial contaminants, such as viruses and bacteria, that may come from sewage treatment plant, septic systems, agricultural livestock operations, and wildlife.

  • Inorganic contaminants, such as salts and metals, that can be naturally-occurring or result from urban stormwater runoff, industrial or domestic wastewater discharges, oil and gas production, mining, or farming.

  • Pesticides and herbicides, that may come from a variety of sources such as agriculture, urban stormwater runoff, and residential uses.

  • Organic chemical contaminants, including synthetic and volatile organic chemicals, that are byproducts of industrial processes and petroleum production, and can also come from gas stations, urban stormwater runoff, agricultural application, and septic systems.

  • Radioactive contaminants, that can be naturally occurring or be the result of oil and gas production and mining activities.

In order to ensure that tap water is safe to drink, US Environmental Protection Agency (USEPA) and the State California Department of Health Services (Department) prescribe regulations that limit the amount of certain contaminants in water provided by public water systems. Department regulations also establish limits for contaminants in bottled water that must provide the same protection for public health.

**RADON** is a naturally occurring radioactive gas that you can't see, taste, or smell. It is found throughout the U.S. Radon can move up through the ground and into a home through cracks and holes in the foundation. Radon can build up to high levels in all types of homes. Radon can also get into indoor air when released from tap water from showering, washing dishes, and other household activities. Compared to radon entering the home through soil, radon entering the home through tap water will in most cases be a small source of radon in indoor air. Radon is a known human carcinogen. Breathing air-containing radon can lead to lung cancer. Drinking water containing radon may also cause increased risk of stomach cancer. If you are concerned about radon in your home, test the air in your home. Testing is inexpensive and easy. Fix your home if the level of radon in your air is 4 picocuries per liter of air (pCi/L) or higher. There are simple ways to fix a radon problem that aren't too costly. For additional information, call your State radon program or call EPA's Radon Hotline (1-800-SOS-RADON).

**ARSENIC:** *After a long debate, the drinking water standard for Arsenic was lowered from 50 ppb (parts per billion) to 10 ppb. The following message is required for systems that have some sources containing Arsenic below the new standard of 10 ppb, but over half (5 ppb). The average in Lodi's wells is 4.4 ppb and the highest well is 9.7 ppb.*

While your drinking water meets the current EPA standard for arsenic, it does contain low levels of arsenic. The standard balances the current understanding of arsenic's possible health effects against the costs of removing arsenic from drinking water. The California Department of Health Services continues to research the health

effects of low levels of arsenic, which is a mineral known to cause cancer in humans at high concentrations and is linked to other health effects such as skin damage and circulatory problems.

**NITRATE:** *The following message is required for systems that have some sources containing Nitrate below the standard of 45 ppm (as NO3), but over half (23 ppm) of the standard. The average of Lodi's wells is 9.2 ppm and the highest well is 36 ppm.*
Nitrate in drinking water at levels above 45 mg/L is a health risk for infants of less than six months of age. Such nitrate levels in drinking water can interfere with the capacity of the infant's blood to carry oxygen, resulting in a serious illness; symptoms include shortness of breath and blueness of the skin. Nitrate levels above 45 mg/L may also affect the ability of the blood to carry oxygen in other individuals, such as pregnant women and those with certain specific enzyme deficiencies. If you are caring for an infant, or you are pregnant, you should ask advice from your health care provider.

## To better understand the report, please note the description of terms and abbreviations

### Terms and Abbreviations Used:

**Maximum Contaminant Level (MCL):** The highest level of a contaminant that is allowed in drinking water. Primary MCLs are set as close to the PHGs (or MCLGs) as is economically and technologically feasible. Secondary MCL's are set to protect the odor, taste, and appearance of drinking water.

**Public Health Goal (PHG):** The level of a contaminant in drinking water below which there is no known or expected risk to health. PHGs are set by the California Environmental Protection Agency.

**Maximum Contaminant Level Goal (MCLG):** The level of a contaminant in drinking water below which there is no known or expected risk to health. MCLGs are set by the U.S. Environmental Protection Agency.

**Regulatory Action Level (AL):** The concentration of a contaminant which, if exceeded, triggers treatment or other requirements that a water system must follow.

**Notification Level (NL):** Health-based advisory levels established by DHS for chemicals in drinking water that lack maximum contaminant levels (MCLs).

**Primary Drinking Water Standard or PDWS:** MCLs for contaminants that affect health along with their monitoring and reporting requirements, and water treatment requirements.

**Maximum residual disinfectant level (MRDL):** The level of a disinfectant added for water treatment that may not be exceeded at the consumer's tap.

**Maximum residual disinfectant level goal (MRDLG):** The level of a disinfectant added for water treatment below which there is no known or expected risk to health. MRDLs are set the U.S. Environmental Protection Agency.

**mg/L or ppm**: Milligrams per liter, or parts per million (one ppm equals a concentration of about one cup in a 60,000 gallon swimming pool).

**ug/L or ppb:** Micrograms per liter, or parts per billion (one ppb equals about 4.5 drops in a 60,000 gallon swimming pool).

**ppt:** Parts per trillion (one ppt equals less than 1/200 of a drop in a 60,000 gallon swimming pool).

**pCi/L:** Picocuries per liter (a measurement of radiation).

**NA:** Not Applicable.

**ND:** Not Detected at measurable amounts for reporting purposes.

**Grains/gal:** Grains per gallon. A hardness measurement often used for softeners and dishwashers. (17.1 mg/L = 1 grain/gal as calcium carbonate).

**umhos/cm:** Micromhos per centimeter (a measurement of conductance).

**<** Means less than the amount shown.
**>** Means more than the amount shown.

# City of Lodi Annual Water Quality Report for 2006

**(published April 2007)**

| Regulated Inorganic Chemicals *2004-2006 Data | MCL | Average of Lodi Wells | Range of Individual Detections | PHG or (MCLG) | Major sources in Drinking water |
|---|---|---|---|---|---|
| Arsenic, ug/L | 10 | 4.4 | 9.7-ND | 0.004 | Erosion of natural deposits (see message below) |

| | | | | | |
|---|---|---|---|---|---|
| **Barium, mg/L** | **1** | **<0.1** | **0.25-ND** | **2** | **Erosion of natural deposits** |
| **Fluoride, mg/L** | **2.0** | **0.05** | **0.37-ND** | **1** | **Erosion of natural deposits** |
| **Nitrate as $NO_3$ , mg/L** | **45** | **9.2** | **36-ND** | **45** | **Leaching from fertilizer use; leaching from septic tanks and sewage; erosion of natural deposits (see below)** |

| **Bacterial Water Quality Coliform Bacteria 2006 Data** | **MCL** | **Total Positive** | **Monthly High-Low Range** | **PHG or (MCLG)** | **Major sources in Drinking water** |
|---|---|---|---|---|---|
| **Total Coliform, Positive** | **5%/month** | **0.29 %** | **2.3 % - 0%** | **(0)** | **Naturally present in the environment** |
| **Fecal Coliform & E. coli** | **>1 /month** | **0** | **0 - 0** | **(0)** | **Human and animal fecal waste** |

| **Radioactivity, pico Curies per Liter, 2005 Data** | **MCL** | **Average of Lodi Wells** | **Range of Individual Detections** | **PHG or (MCLG)** | **Major Sources in Drinking water** |
|---|---|---|---|---|---|
| **Gross Alpha, pCi/L** | **15** | **2.86** | **15.9-0.16** | **(0)** | **Erosion of natural deposits** |
| **Radium 228** | **2** | **0.12** | **0.456-0** | **(0)** | **Erosion of natural deposits** |
| **Uranium, pCi/L** | **20** | **2.66** | **15.8-0** | **0.43** | **Erosion of natural deposits** |

**Organic Chemicals with at least one confirmed detection in an operational City Well**

| **Regulated Organic Chemicals 2006 Data** | **MCL** | **Average of Lodi Wells** | **Range of Individual Detections** | **PHG or (MCLG)** | **Major sources in Drinking water** | **Comments:** |
|---|---|---|---|---|---|---|
| **Tetrachloroethylene (PCE), ppb** | **5** | **0.06** | **2.0** - ND** | **0.06** | **Discharge from factories, dry cleaners, and auto shops (metal degreaser)** | Found in Wells #6R, 8 & 12 at levels below the MCL. |
| **1,1-Dichloroethylene (1,1-DCE), ppb** | **6** | **0.01** | **0.8**-ND** | **10** | Discharge from industrial chemical factories. Local contamination from businesses using the chemical. | **Only in Well # 2 at levels below the MCL** |
| **Trichloroethylene (TCE), ppb** | **5** | **0.08** | **2.1**-ND** | **0.8** | **Discharge from metal degreasing sites and other factories. Local ground contamination from businesses using the chemical. Breakdown product of Tetrachloroethylene (PCE).** | **Only from Wells # 2 & 18 at levels below the MCL.** |
| **Dibromochloro-propane (DBCP), ppt** | **200** | **36** | **320**-ND** | **1.7** | **Banned nematocide that may still be present in soils due to runoff/leaching from former use on vineyards.** | **See the update in the Water Quality section of this report** |

| **Secondary Standards Aesthetic Purposes (see note) *2004-2006 Data** | **Secondary MCL** | **Average of Lodi Wells** | **Range of Individual Detections** |
|---|---|---|---|
| **Chloride, mg/L** | **500** | **15** | **50-3.3** |
| **Color-Units** | **15** | **ND** | **ND** |
| **Specific Conductance, MS/cm** | **1600** | **345** | **810-120** |

| **Secondary Standards Aesthetic Purposes (see note) *2004-2006 Data** | **Secondary MCL** | **Average of Lodi Wells** | **Range of Individual Detections** |
|---|---|---|---|
| **Sulfate, mg/L** | **500** | **14** | **36-ND** |
| **Total Dissolved Solids, mg/L** | **1000** | **248** | **490-120** |
| **Turbidity, NTU Units** | **5** | **0.11** | **0.62-0.02** |

***Note: Aesthetic problems are only associated with taste, smell, and other problems which are not a health risk.***

| **Lead & Copper Rule Customer Tap Monitoring 2006 Data** | **AL (Action Level)** | **Average 90th Percentile** | **Range of Individual Detections** | **# Samples Exceeding AL (of 46 samples from 46 sites)** | **PHG or (MCLG)** | **Major sources in Drinking Water** |
|---|---|---|---|---|---|---|
| **Lead, 90th %, ug/L** | **15** | **<5.0** | **16-ND** | **1** | **2** | **Internal erosion of household plumbing** |
| **Copper, 90th %, mg/L** | **1.3** | **0.32** | **0.60-0.027** | **0** | **0.17** | **systems; erosion of natural deposits** |

| **Unregulated Contaminants Detected 2006 Data** | **Notification Level (NL)** | **Average of Lodi Wells** | **Range of Individual Detections** |
|---|---|---|---|
| **Trichloropropane, ug/L** | **0.005** | **0.003** | **0.089 - ND** |

**Other non-regulated water constituents found in your water (for your information only)**

| **Non-regulated water constituents, *2004-06 Data** | **Average of Lodi Wells** | **Range of Detections** |
|---|---|---|
| **Total Hardness, mg/L as CaCO3** | **133** | **340-40** |
| **Total Hardness, grains/gal.** | **7.8** | **19.9-2.3** |
| **Calcium, mg/L** | **29** | **78-8.2** |
| **Sodium, mg/L** | **22** | **56-1.3** |

| **Non-regulated water constituents, *2004-06 Data** | **Average of Lodi Wells** | **Range of Detections** |
|---|---|---|
| **Potassium, mg/L** | **6.9** | **13-2.3** |
| **Alkalinity (bicarbonate), mg/L** | **168** | **340-63** |
| **pH, in pH units** | **7.4** | **7.8-6.9** |
| **Magnesium, mg/L** | **14** | **35-4.9** |

*** Regulations call for monitoring of some constituents less than once per year because the concentrations of these constituents do not change frequently. Therefore, some of our data, though representative, are more than one year old.**
**** Averages are used for compliance determination due to the variable nature of individual analyses, and due the fact that any associated theoretical risks are not acute, but theoretically only after years of exposure to levels above MCLs.**

# Appendix F Agreement for Purchase of Water from the Woodbridge Irrigation District by the City of Lodi

# AGREEMENT FOR PURCHASE OF WATER FROM THE WOODBRIDGE IRRIGATION DISTRICT BY THE CITY OF LODI

This Agreement is made and entered into between Woodbridge Irrigation District and the City of Lodi, adjoining entities located within the County of San Joaquin, State of California, this 13th day of May, 2003.

Background Recitals.

a. The City of Lodi obtains its municipal water supply from wells located within the City, extracting the water from the underground aquifer, which is replenished in part by flows of the Mokelumne River. Lodi desires to acquire a supplemental surface water supply to avoid being wholly dependent upon the wells and the possible impacts of eventual overdraft of the groundwater supply.

b. Woodbridge Irrigation District (District or WID) is an irrigation district that is organized and existing under Division 11 of the California Water Code (Sections 20,500 et seq). The District is located immediately west of the City of Lodi and immediately north of the City of Stockton. The District diverts water from the Mokelumne River at Woodbridge Dam, located in the NE 1/4 of the SE 1/4 of Section 34, Township 4 N, Range 6 E, MDBM, for irrigation of a net area of 19,370.3 acres within a gross area of 40,441.77 acres and located within Townships 2 N, 3 N, 4 N and 5 N, Ranges 5 E, 6 E and 7 E, MDBM.

c. The District diverts its water supply from the Mokelumne River under pre-1914 appropriative rights for the diversion of water up to 300 cubic feet per second (cfs). The District's pre-1914 rights are overlapped by the District License No. 5945 for the appropriation of 300 cfs per annum from February 1 to October 31 for irrigation use, supplemented by License No. 8214 for the diversion of an additional 114.4 cfs from May 1 to August 31 of each year and from November 1 of each year to January 31 of the succeeding year. The combined rights under the two Licenses together with the District's pre-1914 rights are limited to a maximum diversion of 414.4 cfs.

d. The District, following the East Bay Municipal Utility District's (EBMUD) building of the Pardee and Camanche Reservoirs on the Upper Mokelumne River, entered into Agreements with EBMUD in 1938 after Pardee's completion and again in 1965 after the completion of Camanche, which acknowledged the priority of some of the District rights to the EBMUD rights, and under which agreements EBMUD releases a Regulated Base Supply of water each year from Camanche Reservoir for diversion by the District at Woodbridge Dam for irrigation use.

e. The District's demand for water from the Mokelumne River under its water rights has begun to diminish by reason of the District's water conservation programs, including the conversion of field furrow and flood irrigation methods of application to water applied by drip irrigation and micro-sprinklers, which reduce the amount of applied water for crops. There has also been a reduction in the delivery of irrigation water by reason of the number of irrigated acres being reduced as a result of urbanization of District lands.

f. By reason of the anticipated reductions in water usage within the District, the District has determined that it will have surplus water in certain amounts available under its water entitlements from the Mokelumne River, and the water that would be delivered to the City by this Agreement is surplus to the current needs of the landowners and water users within the District as required by Section 22259 of the Water Code. The District's South Main Canal traverses the westerly portion of the City of Lodi, and the District could deliver water diverted from the Mokelumne River under its water rights to Lodi at a mutually agreeable location along the District Canal System.

g. The water is diverted by the District at Woodbridge Dam, with diversions being facilitated during the irrigation season by the installation of flashboards in the Dam. The flashboards are removed after the end of the irrigation season for Dam maintenance and Dam safety. When the flashboards are in place, water backs up into Lodi Lake and the City's Lodi Park Lake. The Lake is used for fishing, boating and recreational purposes by inhabitants of the City, and its presence during the summer months is an enhancement to the City's Lodi Park Lake. During the periods that the flashboards are not in the Dam, the Lake level is lowered and its utility for fishing, recreation and boating is reduced.

h. Because of its age, it is necessary for the District to replace the existing Woodbridge Diversion Dam in order to provide greater security and protection against dam failure. In doing so, and in reliance on this Agreement, the District intends, subject to any requirements of the Division of Safety of Dams, that the replacement dam structure will be designed and constructed so that water can be impounded behind the dam year round. The estimated cost for replacement of the Dam and appurtenances is approximately $20,000,000.

i. The City of Lodi desires to contract with the District for the purchase of water from the District for use within the City service area, for which the City will pay on the basis and pursuant to the conditions hereinafter set forth.

NOW, THERFORE, WOODBRIDGE IRRIGATION DISTRICT (DISTRICT) AND THE CITY OF LODI (CITY) AGREE AS FOLLOWS:

May 2003
Jan 1, 2004

1. Water to be Made Available to City, and Payment. Beginning in the calendar year which first follows the entry of a final judgment confirming the validity of this Agreement pursuant to Chapter 9 (commencing with Section 860) of Title 10 of Part 2 of the Code of Civil Procedure, and continuing through the term of this Agreement, the District shall make available to the City out of its Regulated Base Supply under its Agreement with EBMUD, 6,000 acre feet per annum under the terms and conditions herein set forth. In consideration thereof, the City will pay the District annually the sum of ONE MILLION TWO HUNDRED THOUSAND DOLLARS ($1,200,000.) Payments thereon of $300,000 quarterly are due and payable in advance beginning on the first day of each calendar quarter, commencing on the first day of the calendar year which follows said entry of a final judgment confirming the validity of this Agreement. Said payments shall be made irrespective of whether the City takes the water made available to it under this Agreement and irrespective of whether the District has water available for delivery to the City, provided that the District shall make its best efforts to provide to the City the amounts of water provided for in this Agreement.

October 2003 ?

Prior to the commencement of the first full calendar year following the entry of said final judgment, i.e., in the year in which the entry of the final judgment occurs, the City shall make quarterly payments to the District of $300,000 on the first day of each calendar quarter in that year which follows the entry of the final judgment by more than thirty days, in consideration for which one-fourth of 6,000 acre feet of water shall be made available to the City in the that initial year for each calendar quarter for which such payment is made. Any of such water which is not taken by City in that initial year shall be included as a part of the 18,000 acre feet of carryover water which the City may take at a later date as provided for in paragraph 6.a. hereof.

2 Construction of New Dam by Woodbridge. The District has secured the required permits from the Federal and State agencies and the necessary environmental clearances for the construction of a new Woodbridge Dam to replace the existing Dam together with appurtenant facilities, and the District will proceed with construction as soon as is feasible utilizing the revenues to be paid under this Agreement to finance a portion of the costs of the project.

3. Point of Delivery and Time of Delivery. The District agrees to deliver the water to the City at a point or points on the District's Canal at a mutually agreeable location or locations, to be determined at a later date. The water will be delivered during the period from March 1 through October 15. The City shall construct at its sole cost and expense the facilities needed to measure and take delivery of water from the District Canal, and the design, construction and operation thereof shall be approved by the District. The City will be responsible for all costs of operation, repair, maintenance and replacement of such facilities. The measurement facilities shall be recalibrated annually at the City's

expense as requested by the District and the District shall have a continuing right to test the accuracy of such facilities.

a. The City shall provide the District, by January 1 of each year, an estimate of the maximum amount of water anticipated to be needed by the City during each month of that year from March 1 through October 15, which scheduling will be subject to the District's approval. The District will supply such water on said approved monthly schedule pursuant to and as limited by the terms, conditions and limitations of this Agreement; provided that the City shall to the extent that its operations will permit, schedule the taking of as much of its entitlement to water from the District that year prior to July 1 as is feasible, but in any event not less than 3,000 acre feet.

b. At such times as it is possible for the District to deliver water during the remaining months of the year, or to deliver water in excess of 6,000 acre feet during the period from March 1 through October 15, then by mutual agreement of the parties, delivery of such water to the City may be made by the District. The City shall pay the District $100 per acre foot for any such additional water delivered to the City.

c. The water furnished by the District under this Agreement shall be used or furnished by the City only for domestic, municipal, industrial, irrigation and other beneficial uses.

d. The District further agrees that it will, during the term of this Agreement at the City's request, divert from the Mokelumne River at the District's Woodbridge Dam and wheel and convey through the District's canal system to the City's delivery point(s), any non-District water acquired by or available to the City, subject to the District having available capacity for that purpose and subject to the City paying a per-acre-foot charge in an amount which the District determines to be its costs for such service. The District's cost for such service in year 2003 would be $20 per acre-foot.

e. Commencing on January 1 of the seventh year following the year in which execution of this Agreement occurs, the amounts payable to the District under paragraph 1, and the amounts payable to the District under subparagraphs 2.b. and 2.d., shall be increased by two percent per year above the amounts payable during the preceding calendar year. In the event that the annual change in the Consumer Price Index (CPI-W, unadjusted U.S. average) published in December of each year by the United States Bureau of Labor Statistics, commencing in December in the year preceding such seventh year, has increased more than two (2) percent above the December Index of the prior year, the increases in the amounts payable in the ensuing year shall be in the percentage of that increase; provided that any such annual increase shall not exceed five percent (5%).

f. The payments by the City to the District under this Agreement shall be deemed to include the payment during the term of the Agreement of all District groundwater recharge fees on parcels within the City of Lodi which are also located within the boundary of the District.

4. Term of Agreement. (a) This Agreement shall be effective from the date of execution hereof, and shall remain in effect for a term of forty (40) years from said date.

(b) Upon receipt by the District of written notice and request for renewal from the City at least two years in advance of the termination of the Agreement, the District agrees to negotiate with the City for a renewal of this Agreement for an additional forty (40) year term, on terms and conditions that are reasonable and equitable and which are satisfactory to the District.

(c) The District agrees that it will not enter into any agreement during the initial term of this Agreement to provide water to others outside of the District except upon terms which provide that such supply shall be subordinate to the City's rights to be furnished water under this Agreement (except as the City may otherwise specifically agree to). The parties may contract for the delivery of additional amounts of water that may become available upon terms mutually agreeable to the parties. The City shall have a first right of refusal to purchase any water which the District agrees during the initial term of this Agreement to provide to any other purchaser, upon the same terms and conditions provided in such other proposed sale of water.

5. City Payments to be Made from City's Water System Revenues. The City shall make payments under this Agreement solely from the Revenues of, and as an operating expense of, the Lodi Municipal Water System. The City hereby pledges the Revenues to the payments required hereunder. Nothing herein shall be construed as prohibiting the City from using any other funds and revenues for purposes of satisfying any provisions of this Agreement. So long as the City is in compliance with all of its obligations hereunder, such pledge shall not prevent its application of Revenues to other operating expenses of the Lodi Municipal Water System or, subject to the payment of such operating expenses, to other lawful purposes, or impair the rights of any recipient of Revenues lawfully so applied.

"Revenues" means "all gross income and revenue received or receivable by the City from the ownership and operation of the Lodi Municipal Water System, which gross income and revenue shall be calculated in accordance with generally accepted accounting principles, including all rates, fees, and charges received by the City for water service and connection and hook-up fees and all other income and revenue howsoever derived by the City from the ownership and operation of or arising from the Lodi Municipal Water System, but excluding in all cases any proceeds or taxes and any refundable deposits made to establish credit,

federal or state grants, or advances or contributions in aid of construction".

"Lodi Municipal Water System" means "the municipal water system of the City existing on the effective date of this Agreement and all additions, betterments, extensions and improvements thereto hereafter acquired or constructed".

6. City Cooperation in District's Funding of Reconstruction of Woodbridge Dam. The City agrees to cooperate with District in connection with any financing undertaken by District in connection with the reconstruction of the Woodbridge Diversion Dam and to provide to District such certificates, statements and information as District shall reasonably require in connection with such financing, including, without limitation, information relating to the Lodi Municipal Water System and the Revenues, and to provide such information as may be reasonably required in connection with the continuing disclosure undertaking to be entered into by the City pursuant to Rule 15c2-12(b)(5) of the Securities Exchange Commission in connection with the District financing.

7. No Permanent Water Right, and Dry Year Curtailments. The District has determined that the water to be made available annually for delivery to the District pursuant to this Agreement will be surplus to the needs of the District during the term of this Agreement. The parties further agree that no permanent right to the water supplied by the District shall accrue to the City except pursuant to and as limited by the terms of this Agreement.

a. The District agrees that it will deliver up to 6,000 acre feet per annum to the City under this Agreement except to the extent that the District's Regulated Base Supply of 60,000 acre feet under its Agreements with East Bay Municipal Utility District is reduced in dry years by thirty-five (35) percent. In the event of such a reduction, the District may reduce the amount of water to be provided under this Agreement by up to fifty percent (50%). District shall on or about May 1 of each year make a preliminary estimate of whether the City's deliveries may be curtailed that year, and will provide a final estimate of any curtailment on or about July 1. In such event, the City shall only be obligated to take 50% of its estimated delivery before July 1 in that year. There shall be no reduction in the amount of the City's annual payment to the District in such years under paragraph 1.

b. Except for noncompliance with the foregoing provisions of this paragraph, the City shall have no claim for damages or breach arising from the unavailability of surplus water from the District for any cause or condition.

8. Carryover of Entitlements. Unused water may not be carried over by the City

from year to year except that the right to receive water may be "banked," as follows:

a. If during the first three years in which the water is available to the City under this Agreement, the City does not take the water or takes less than the amounts which are available, then the City may carry over and have credit for the water not taken, not to exceed a total of 18,000 acre feet, for later delivery during the initial 40-year term of this Agreement, at such times as the District has extra water available as determined solely by the District. There will be no additional charge for the delivery of such banked water.

b. If after said initial three years delivery of water to the City is curtailed under paragraph 7.a. by reason of a dry year condition or by District's maintenance or other District activities, then the City may carry over and have credit for the amount of such curtailment for later delivery at such time(s) as the District has extra water available as determined by the District. Any City credits for curtailed segments of carryover water shall expire at the end of eight (8) years from the end of the period in which the curtailment for that segment of curtailed water occurred. Such credits for the delivery of curtailed carryover water within said eight-year period may extend beyond the termination of this Agreement. There will be no additional charge for the delivery of such banked water.

c. Except as provided in subparagraph a, no credits shall accrue for water that is available to but is unused by the City.

9. Water Quality, Temporary Interruptions, and Responsibility for the Water Beyond Point of Delivery.

a. The water being supplied to the City is raw water diverted from the Mokelumne River, and the character or quality of the water furnished hereunder may vary from time to time. District does not guarantee in any respect the character or quality of the water furnished pursuant to this Agreement, provided that the District shall not apply or use any chemicals within the Canal section used to deliver water to the City that the City determines to be deleterious to the quality of the water for the uses made by the City of such water.

b. It is agreed that there may be, in addition to shortages of water, temporary discontinuance or reduction of water to be furnished for the City as herein provided, for purposes of investigation, inspection, maintenance, repair or replacement as may be necessary of any of the facilities used by the District for furnishing water to the City. The District agrees to provide the City notice of such temporary discontinuance or reduction of water as soon as such information is available to the District.

c. The City shall hold the District harmless from and defend the District from all claims or expenses on account of damage or claim of damage of any nature whatsoever from which there is legal responsibility, including property damage, personal injury or death, arising out of or connected with the delivery, control, carriage, handling, use, or disposal or distribution of water furnished hereunder beyond the point of delivery of water into the City's system from the District's Canal.

10. Right of Termination for Unacceptable Conditions in Validation Judgment. In the event that the court in the validation action enters a judgment validating the Agreement but upon conditions or restrictions which impose upon either party costs, requirements, obligations, or limitations in their performance of the agreement or upon their operations or property interests which in that party's judgment are unacceptable or otherwise not in the best interests of that party, that party shall have the right to terminate this Agreement, and in that event neither party shall have any further liability or obligation to the other party hereunder.

11. Arrearage in Payments. No water shall be furnished to the City during any period in which the City may be in arrears in payment of charges accruing hereunder after the determination on the amount thereof as above provided. Interest on arrearage in payment shall be charged at a rate of 1-1/2% per month and compounded monthly, commencing 45 days after the due date of the payment.

12. Assignment. The provisions of this contract shall apply to and bind the successors and assigns of the respective parties hereto; but no assignment or transfer of this contract or any part thereof or interest therein by the City shall be valid unless and until approved in writing by the District; and no assignment of the obligation to provide or deliver the water shall be assignable by the District without the consent of the City.

13. Fees and Costs. Any fees, costs or expenses, including attorney fees, administrative costs, and consultant fees, incurred by the District to effect the sale of water to the City, together with CEQA and any other regulatory approval, shall be paid by District and City on a 50/50 basis. The City shall not be required to contribute to any fees or costs incurred by District relating to other issues or disputes that may arise in any of said proceedings not directly relating to City's use of District water. District shall provide to City invoices and accountings of said fees and expenses on a regular basis.

14. City Use of District Rights of Way. The District agrees to cooperate with City and to agree to the City's use of any District right of way along the District's Main Canal needed by the City for the conveyance or distribution of water it obtains from the District.

15. CEQA. The parties agree that the District will be Lead Agency for purposes of

compliance with any requirements of the California Environmental Quality Act pertaining to the execution of this Agreement by each party.

16. Entire Agreement. This Agreement contains the full and entire Agreement of the parties and there are no other conditions, either explicit or implied, nor any warranties or promises other than those contained within the written terms of this Agreement.

17. Time of the Essence. Time is of the essence in the performance of this Agreement.

18. Nonwaiver. The failure of either party to enforce or abide by a term or condition of this Agreement shall not constitute a waiver of that term or condition unless a written Agreement is prepared specifically providing for the waiver or forgiveness of that term and such Agreement is executed by each party hereto.

19. Date of Execution. The date of execution of this Agreement is the date of execution by the party last signing the Agreement.

IN WITNESS WHEREOF, the parties hereto have executed this instrument on the 13th day of May, 2003.

WOODBRIDGE IRRIGATION DISTRICT

By _____

Attest: _____

CITY OF LODI, A MUNICIPAL CORPORATION

By _____
Susan Hitchcock, Mayor

Attest: _____
Susan J. Blackston, City Clerk

APPROVED AS TO FORM: _____
Randall A. Hays, City Attorney

4/16/03

**RESOLUTION NO. 03-09-06-01**
**Of WOODBRIDGE IRRIGATION DISTRICT**
**AUTHORIZING EXECUTION OF AN AMENDMENT EXTENDING THE AGREEMENT WITH LODI FOR ADDITONAL FOUR YEARS**

WHEREAS. The City of Lodi has requested that its 40-year Agreement for Purchase of Water from the District, entered into on May 13, 2003, be extended for an additional four years, and also that the City be allowed to continue to bank unused water for an additional four years beyond the existing cutoff date of May 13, 2006; and

WHEREAS, the Board of Directors of the District are agreeable to granting such extension in the form of an Amendment as finally approved by the President; and

WHEREAS, the Board of Directors also wishes to inform Lodi that the District believes strongly that the highest and best use of the water by the City would be through a new surface water treatment plant and delivery to the City's customers rather than through groundwater recharge;

BE IT RESOLVED BY THE BOARD OF DIRECTORS OF WOODBRIDGE IRRIGATION DISTRICT, as follows:

Section 1. The President and Secretary are authorized and directed to execute a First Amended Agreement with the City of Lodi, to extend the termination date of the Agreement from May 13, 2043 to September 30, 2047, and to allow the City to continue to bank unused water up to 6,000 acre-feet per annum for an additional four years from May 13, 2006 to October 15, 2010, not to exceed a total of 24,000 acre feet. The First Amended Agreement shall in form and substance as recommended by the Manager and Attorney and approved by the President.

ADOPTED the 9th day of March, 2006, by the following vote:

AYES: Directors Stokes, Shinn , Van Exel and McQueen

NOES: None

ABSENT: Luchessi

Signed: _____
William Stokes, President

Attest: _____
Anders Christensen, Secretary


Mar 15 06 08:13a

# Appendix G CD of City of Lodi White Slough WPCF Soil and Groundwater Investigation Existing Conditions Report

# Appendix H TM No. 2: Land Application: Future Nitrogen Loading Conditions

WEST YOST
ASSOCIATES
*Consulting Engineers*

# TECHNICAL MEMORANDUM NO. 2

DATE: June 15, 2007 Project No.: 711-04-05-02.007

TO: Richard Prima

FROM: Melanie Carr MAC Reviewed By: Kathryn Gies

SUBJECT: Technical Memorandum No. 2: Land Application: Future Nitrogen Loading Conditions

West Yost Associates (WYA), in collaboration with Dr. Mitchell Johns, an agronomist and professor of Plant and Soil Science at California State University, Chico, is preparing a Groundwater Investigation Study for the City of Lodi (City) Water Pollution Control Facility (WPCF). In September 2006, the project team submitted the Existing Conditions Report, which provided several recommendations for further evaluation of the potential impacts of the City's recycled water irrigation practices. Recently, the project team completed a historic field loadings technical memorandum (TM #1) that presented design nitrogen uptake and loading rates.

The purpose of this TM is to describe the projected future nitrogen loading conditions. These projected nitrogen loadings will be used to estimate the additional land required, if any, to accommodate future reclaimed water flows and biosolids production. Based on the information presented herein, additional land application area will be required to assimilate the projected future reclaimed water and biosolids total nitrogen loadings at agronomic rates. TM #3 will synthesize the information from the Existing Conditions Report, TM #1 and TM # 2 to provide an assessment of the recommended Land Management Best Practicable Treatment Controls for the Lodi WPCF.

As discussed in TM#1, the primary cause of historic excess nitrogen loadings to the City's field areas are as follows:

1. Elevated nitrogen concentrations in the applied irrigation water
2. Historic biosolids applications

However, issues with irrigation water and biosolids application are distinct and require two different solutions to adequately assimilate their nitrogen loads. Therefore, the requirements for addressing these two issues are discussed separately below. The specific topics discussed are as follows:

- Conclusions and Recommendations
- Recycled Water Applications

1260 Lake Boulevard, Suite 240 Davis, California 95616 Phone 530 756-5905 Fax 530 756-5991 email: mail@westyost.com

- Biosolids Applications
- Total Land Area Requirements Summary
- Existing and Future Total Loading Conditions

## CONCLUSIONS AND RECOMMENDATIONS

The purpose of TM #2 is to develop and describe the future nitrogen loading conditions for the land application area. The nitrogen loadings were used to estimate the land required, if any, to accommodate future reclaimed water flows and biosolids production. Based on the information presented in TM #2, additional land application area will be required to assimilate the projected future reclaimed water and biosolids total nitrogen loadings at agronomic rates.

Irrigation water and biosolids application are evaluated separately as two distinct issues to adequately assimilate their nitrogen loads, and are described as follows:

- Recycled Water Applications
- Biosolids Loadings
- Summary of Existing and Future Conditions

### Recycled Water Applications

The major sources of reclaimed water at the WPCF are expected to change in the next few years due to the following planned modifications:

- WPCF discharges are anticipated to increase to 8.5 mgd
- Improved nitrogen reductions in the WPCF municipal treatment process will result in an average effluent TN concentration of 8 mg/L
- Biosolids lagoon supernatant and DAFT subnatant flows will be removed from the land application system
- PCP cannery flows will approximately double to 216 MG per year, and will comprise the dominant total nitrogen load to the land application system
- Winery wastewater flows will approximately double to 2.5 MG per year, but will not contribute significantly to the total nitrogen load

Other minor sources that contribute to the irrigation flows are anticipated to remain relatively similar to existing conditions. These flows were not included in the analysis, as they would not appreciably change the land applied total nitrogen concentration.

Based on the results of the analysis using the 95th percentile historic nitrogen concentration of the PCP flows, a minimum of 355 acres should be planted in alfalfa each year to assimilate the nitrogen that will be applied late in the irrigation season from the PCP cannery flows. A total of 880 acres will need to be available for agronomic irrigation purposes during the remainder of the year. Therefore, a minimum of 15 acres of additional land is required to accommodate increases in reclaimed water irrigation flows.

**Biosolids Loadings**

Design considerations for the following facilities were used in the analysis:

- Primary Sedimentation Basins: 65 percent capture rate, 4 percent solids
- Secondary Solids Production: 80 percent volatile fraction; a range of WAS solids production was used to bracket required land application area for biosolids
- DAFT Thickening: range of 50 to 95 percent capture was used, 4.5 percent solids
- Anaerobic Digesters: 50 percent VSS reduction
- Biosolids Lagoon: 30 percent additional VSS reduction, 85 percent capture rate

A range of scenarios was evaluated for this TM #2. Scenario 2a & b, (95% DAFT Solids Recovery, 30% VSS Reduction in Lagoons, 85% Solids Capture) is recommended for design purposes. Using this scenario, approximately 475 to 510 acres of corn/wheat are required for biosolids application under current conditions, and approximately 655 to 690 acres of corn/wheat are required for 2020 buildout conditions.

A total of 865 acres is required under current conditions for both reclaimed water and biosolids land application. Future conditions require up to a total of 1,045 acres for both reclaimed water and biosolids land application. Therefore, additional land purchase will likely be required.

Additional investigation will be needed to more accurately define the required land area for reclaimed water and biosolids land application. The amount of land area required is highly dependent on several unknown factors, in particular the biosolids and cannery nitrogen concentrations. Moreover, other means of treatment could be considered that would further reduce biosolids and cannery nitrogen concentrations. These treatment alternatives will be addressed in TM #3.

**Existing and Future Total Loading Conditions**

Because total nitrogen has historically been regulated as the limiting constituent for land application design, total nitrogen concentrations and flows are used to size additional land area requirements for both reclaimed water and biosolids. However, after additional data collection, TDS and BOD loadings will be revisited to determine if additional area would be required to assimilate these constituents. Finally, pretreatment of cannery wastewater is being considered, which would result in reductions of TN, TDS and BOD loadings.

## RECYCLED WATER APPLICATIONS

As discussed in TM #1, the primary causes of the elevated nitrogen concentrations in the applied recycled water are as follows:

- Biosolids lagoon supernatant and Dissolved Air Flotation Thickener (DAFT) subnatant flows directed to storage ponds during the winter months that are later applied to the agricultural areas during the early spring
- Pacific Coast Producers (PCP) cannery wastewater flows directed to the land application areas June through September

The total nitrogen field loadings associated with these reclaimed water components would be reduced if adequate low-nitrogen concentration water could be blended with the relatively high-nitrogen concentration flows from the biosolids supernatant, DAFT subnatant, and PCP cannery wastewater. However, additional land may be necessary to ensure that the blended flows can be applied at agronomic rates. The following section presents the anticipated flows and associated land application areas that would be needed to achieve this objective. The specific topics discussed are as follows:

- Irrigation Water Nitrogen Concentrations and Flows
- Required Irrigation Area Calculations
- Recommendations

### Irrigation Water Nitrogen Concentrations and Flows

Nitrogen concentrations in reclaimed water at the WPCF are expected to change in the next few years due to the following planned modifications:

- Increased discharges from the WPCF municipal treatment process
- Improved nitrogen reductions in the WPCF municipal treatment process
- Removal of biosolids lagoon supernatant and DAFT subnatant flows from the land application system
- Increased discharges to the irrigation area from the PCP cannery
- Increased disposal of winery wastewater to the land application system

The anticipated future conditions resulting from these modifications are critical in determining the amount of land area required to assimilate the blended irrigation flows. Therefore, projected municipal effluent, supernatant and subnatant flows, PCP cannery, and winery wastewater total nitrogen concentrations and flows are described below in detail.

Other minor sources contribute to the irrigation flows associated with the City WPCF, including industrial line and onsite winter runoff, and other industrial flows. These minor flows are anticipated to remain relatively similar to existing conditions. These flows have relatively low nitrogen concentrations; therefore, the addition of these flows would slightly decrease the total applied nitrogen concentration. To be conservative, these flows were not included in the analysis, as these flows would not appreciably affect the nitrogen concentration of the applied recycled water.

Municipal Effluent

The City is in the process of constructing improvements to the WPCF municipal secondary treatment facilities to allow for improved nitrification and denitrification. The maximum permitted effluent total nitrogen concentration is slightly greater than 10 mg/L as N. However, land application is evaluated on an annual basis, and the average condition would be somewhat lower than the peak design condition. As a result, the future effluent total nitrogen concentrations are anticipated to be less than 8 mg/L. Therefore, higher nitrogen concentration flows from the PCP cannery and winery wastewater could be diluted with the municipal effluent to achieve the desired irrigation water nitrogen loading rate.

Municipal effluent monthly dry season flows are also expected to increase to the 2020 buildout flow of 8.5 mgd. Therefore, a significant amount of low-nitrogen concentration water could potentially be available for blending. Any treated effluent flow not needed for irrigation would be discharged to Dredger Cut; therefore, there is no need for additional land solely to dispose of municipal effluent flows.

Supernatant and Subnatant Flows

The City is in the process of constructing the facilities needed to direct the biosolids supernatant and DAFT subnatant flows to the aeration basins, in lieu of the existing route to storage ponds and ultimately to the land application system. The storage pond total nitrogen concentrations will measurably decrease following removal of these flows, and the major source of relatively high nitrogen concentrations early in irrigation season will be eliminated. Therefore, the supernatant and subnatant flows are not included in the future conditions analysis. Additional future municipal effluent flows will replace the irrigation water currently provided by the supernatant and subnatant flows. Subnatant flows do not necessarily need to be rerouted, as solids could be reduced through use of polymers or decreasing DAFT loading rates. However, for purposes of this analysis, it was assumed that the DAFT subnatant flows would be rerouted.

PCP Cannery

PCP cannery flows are expected to increase to approximately double existing flows. The following major assumptions were used to evaluate the potential nitrogen loadings associated with the flow increase:

- Future PCP cannery flows will be as shown in Table 1 (data provided by PCP):

**Table 1. Projected PCP Cannery Flows for Future Loading Conditions**

| Discharge Period | Average Daily Flow, gpd | Days of Discharge | Total Gallons for Period |
|---|---|---|---|
| June 15 – July 14 | 900,000 | 30 | 27,000,000 |
| July 15 – September 30 | 3,000,000 | 78 | 234,000,000 |
| Total | | 108 | 261,000,000 |

- PCP cannery monthly flow distribution will be similar to historic patterns, as shown in he Table 2:

**Table 2. Monthly PCP Lodi Cannery Flows (Million Gallons)**

| Month | Flow, MG |
|---|---|
| April | 5.2 |
| May | 2.0 |
| June | 23.0 |
| July | 56.6 |
| August | 86.6 |
| September | 37.4 |
| October | 5.2 |
| Total | 216.0 |

- Future total nitrogen concentrations will be similar to historic patterns observed at the PCP's Oroville and Lodi canning facilities, as shown in Table 3:

**Table 3. Total Nitrogen Concentrations from PCP's Lodi and Oroville Canning Facilities (mg/L)**

| Month | 50th Percentile | 90th Percentile | **95th Percentile** | 99th Percentile |
|---|---|---|---|---|
| April | 2.2 | 2.2 | **2.2** | 2.2 |
| May | 3.4 | 3.4 | **3.4** | 3.4 |
| June | 4.1 | 8.6 | **12.7** | 18.5 |
| July | 33.9 | 78.9 | **85.3** | 89.9 |
| August | 38.2 | 61.7 | **64.3** | 65.4 |
| September | 20.7 | 32.4 | **45.8** | 58.8 |
| October | 32.2 | 47.9 | **48.2** | 48.4 |

Because the required land application areas are particularly sensitive to the cannery total nitrogen concentrations, various percentiles of the total nitrogen concentration data were developed. For purposes of this analysis, the 95th percentile of the total nitrogen concentration data was used to estimate nitrogen loadings.

Winery Wastewater

Winery wastewater flows are also expected to increase to more than double existing flows. Currently, Van Ruiten Winery is permitted to discharge 3,600 gpd on a monthly basis, while Jessie's Grove winery is permitted to discharge 2,000 gpd on a monthly average. Although these winery wastewater flows are relatively small, the nitrogen concentrations can be significant, resulting in measurable nitrogen loads. Therefore, these flows are also to be considered when evaluating future nitrogen loading conditions. The following major assumptions were used to evaluate the potential nitrogen loadings associated with these flows:

- Projected future annual winery wastewater flows will be 2.5 million gallons per year, per WPCF staff.
- Winery wastewater monthly flow patterns will be similar to the Van Ruiten winery, which currently discharges approximately 1 MG per year to the City WPCF, as shown in Table 4:

**Table 4. Projected Monthly Winery Wastewater Flows (Million Gallons) [a]**

| Month | Flow |
|---|---|
| April | 0.1 |
| May | 0.1 |
| June | 0.2 |
| July | 0.3 |
| August | 0.4 |
| September | 0.2 |
| October | 0.2 |
| Total | 1.4 |

- Approximately 1.1 MG of the winery wastewater flows will be discharged between November and April and will be directed to the onsite storage ponds.
- Winery wastewater flows will be the greatest during bottling (which typically occurs in March) and these flows will be directed to the onsite storage ponds.
- The estimated winery wastewater total nitrogen concentration is 42 mg/L, a maximum value observed at the Woodbridge Winery.

**Required Irrigation Area Calculations**

The following steps were implemented to calculate the additional irrigation area requirements for the WPCF field areas:

1. Calculate the maximum allowable monthly recycled water total nitrogen concentrations.
2. Calculate the amount of municipal wastewater needed to blend with the cannery and winery flows to achieve the calculated allowable concentrations.
3. Calculate the amount of irrigation area necessary to dispose of these combined flows at agronomic rates.
4. Calculate the total volume of required municipal effluent irrigation water per month and the corresponding combined flow nitrogen concentrations.

These steps are described in detail as follows:

Maximum Allowable Total Nitrogen Concentrations

The maximum allowable monthly reclaimed water total nitrogen concentrations can be developed for both alfalfa and corn crops, and for the two different soil types within the WPCF field areas. The maximum allowable monthly reclaimed water total nitrogen concentration can be calculated by dividing the allowable nitrogen loading rates ($L_n$) that were presented in TM #1 by the theoretical crop irrigation demands ($L_w$) that were also presented in TM #1. To be conservative, the minimum of these maximum allowable total nitrogen concentrations should be used as the design basis for determining the required land application area for reclaimed water. The applicable allowable nitrogen loading rates and theoretical crop irrigation demands are presented in Table 5.

**Table 5. Allowable Nitrogen Loading Rates ($L_n$), Crop Irrigation Demands (Lw), and Allowable Irrigation Water Nitrogen Concentration for Specific Crops and Soil Types**

| Month | $L_n$ | $L_w$ | Concentration | $L_n$ | $L_w$ | Concentration |
|---|---|---|---|---|---|---|
| | Guard | | | Devries | | |
| **Alfalfa** | | | | | | |
| April | 39 | 6 | 30 | 40 | 6 | 29 |
| May | 55 | 8 | 29 | 58 | 9 | 27 |
| June | 68 | 10 | 31 | 71 | 11 | 30 |
| July | 75 | 10 | 33 | 78 | 11 | 32 |
| August | 73 | 9 | 36 | 76 | 10 | 34 |
| September | 50 | 7 | 32 | 53 | 8 | 30 |
| October | 30 | 4 | 31 | 32 | 5 | 30 |
| **Corn** | | | | | | |
| April | 16 | 3.2 | 23 | 19 | 4 | 21 |
| May | 50 | 7.3 | 30 | 53 | 8 | 29 |
| June | 75 | 10.0 | 33 | 78 | 11 | 32 |
| July | 73 | 9.1 | 35 | 76 | 10 | 34 |
| August | 16 | 3.2 | 23 | 19 | 4 | 21 |
| September | — | — | — | — | — | — |
| October | — | — | — | — | — | — |

Note, however, that the monthly allowable nitrogen loading rates ($L_n$) presented in TM #1 were based on an assumed fraction (F) of applied nitrogen removed by nitrification and volatilization of 25 percent. While the use of this fraction was appropriate for evaluating historic loading conditions in TM #1, monthly flow-weighted F values are recommended for use when considering required land areas to assimilate peak cannery flows. Therefore, monthly flow-weighted F values were developed for use in this analysis. A nitrification and volatilization F value of 15 percent was assumed for municipal flows and an F value of 50 percent was assumed for cannery and winery wastewater flows, as recommended by the USEPA.

The calculation of the nitrification and volatilization (F) value is determined on an iterative basis, as the fraction of applied municipal flow will vary depending on the allowable uptake rates. Additionally, the fraction of applied municipal flow will also vary depending on the nitrogen concentration of the cannery wastewater. The amount of acreage required to assimilate the cannery wastewater is highly dependent upon the cannery wastewater concentration. Therefore, a range of cannery wastewater total nitrogen concentration percentiles was developed. As mentioned previously, the 95th percentile concentration is recommended for the design condition. A summary of the calculated allowable monthly uptake rates and the associated nitrification and volatilization values (F) for the four cannery wastewater design conditions discussed in the previous section is presented in Table 6.

**Table 6. Variable Nitrification and Volatilization Fractions (F) and Allowable Monthly Reclaimed Water Total Nitrogen (TN) Concentrations (mg/L)**

| Month | Cannery Wastewater Nitrogen Concentration Percentiles | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | 50th | | 90th | | **95th** [a] | | 99th | |
| | F [b] | TN | F | TN | **F** | **TN** | F | TN |
| April | 15.1% | 23.7 | 15.1% | 23.7 | **15.1%** | **23.7** | 15.1% | 23.7 |
| May | 15.0% | 21.0 | 15.0% | 21.0 | **15.0%** | **21.0** | 15.0% | 21.0 |
| June | 22.5% | 28.7 | 19.4% | 27.9 | **19.0%** | **27.8** | 18.8% | 27.8 |
| July | 30.2% | 31.9 | 23.5% | 30.3 | **23.1%** | **30.2** | 22.9% | 30.1 |
| August | 40.6% | 34.0 | 29.3% | 31.2 | **28.7%** | **31.1** | 28.4% | 31.0 |
| September | 29.3% | 30.0 | 23.0% | 28.6 | **22.6%** | **28.5** | 22.4% | 28.4 |
| October | 22.4% | 29.5 | 20.9% | 29.2 | **19.0%** | **28.7** | 18.1% | 28.5 |

(a) 95th percentile recommended for use in design.
(b) Flow weighted F value is determined using a flow weighted average of the F values.

Required Municipal Wastewater Flows

The information presented above was used to determine the amount of municipal effluent flow needed to dilute cannery and winery wastewater total nitrogen concentrations to meet the most limiting total nitrogen design loadings for the WPCF field areas. As discussed, the minimum municipal effluent flows required for blending are dependant upon the monthly allowable reclaimed water total nitrogen concentration, which is dependant upon the nitrification and volatilization fraction (F), which in turn is dependant upon the fraction of total applied municipal effluent flows applied. Therefore, all four of these values were determined in an iterative process. The calculated minimum monthly municipal effluent volumes to dilute the nitrogen concentrations to acceptable values are presented in Table 7. Similar to the monthly allowable reclaimed water total nitrogen concentrations, the minimum monthly municipal wastewater irrigation volumes are also dependant on the assumed concentration of applied cannery wastewater. The 95$^{th}$ percentile monthly concentrations values are the recommended design basis for determining the required land application areas.

**Table 7. Minimum Monthly Municipal Wastewater Irrigation Volumes Required to Control Nitrogen Loadings to Fields (Million Gallons)**

| Month | Cannery Wastewater Nitrogen Concentration Percentiles | | | |
|---|---|---|---|---|
| | 50th | 90th | **95th** [(a)] | 99th |
| April | 0 | 0 | **0** | 0 |
| May | 0 | 0 | **0** | 0 |
| June | 0 | 0 | **0** | 0 |
| July | 12 | 132 | **149** | 161 |
| August | 31 | 123 | **133** | 137 |
| September | 0 | 7 | **31** | 55 |
| October | 1 | 5 | **5** | 5 |

(a) 95th percentile recommended for use in design.

Required Irrigation Area

The required irrigation areas were calculated by dividing the total flow (sum of the municipal, cannery and winery flows) by the theoretical crop irrigation demands ($L_w$), which vary by crop. Therefore, the land area requirements are dependant upon which crops are assumed to be planted.

Perennial crops like alfalfa and an alfalfa/ryegrass mixture were recommended in TM #1 for the reclaimed water application in WPCF field areas because these crops require both irrigation water and nitrogen late in the irrigation season when other crops, like corn, have already been harvested. Therefore, irrigation water demands for alfalfa were used to calculate the total alfalfa area needed to assimilate nitrogen loading associated with cannery flows in September and October, which is after corn has historically been harvested on the City's properties.

Field crops like corn are preferred for biosolids applications at the WPCF due to the fact that the harvesting practices are relatively consistent in nature. However, it is recommended that such crops be rotated with a winter cover crop like wheat, such that uptake of mineralized organic nitrogen can occur year round. For these reasons, it was assumed that all land area not planted in alfalfa would be planted in a corn/wheat combination. The total amount of land required is based on how much land is needed to assimilate both the nitrogen concentration from the cannery wastewater, and the amount of municipal effluent required to reduce the nitrogen concentration of the cannery. The irrigation water demands for a mixture of corn and alfalfa were used to calculate the total irrigation area needed to assimilate nitrogen loading associated with applications in April through August.

A summary of the calculated required land application areas for each of the cannery wastewater concentration percentiles described above is presented in Table 8. Additional details regarding the analysis used to develop the information presented in Table 8 are provided in Appendix A.

**Table 8. Required Reclaimed Water Land Application Area [a]**

| Crop | Cannery Wastewater Concentration Percentiles | | | |
|---|---|---|---|---|
| | 50th | 90th | **95th[b]** | 99th |
| Alfalfa | 195 | 230 | **355** | 475 |
| Corn | 275 | 610 | **525** | 425 |
| Total | 470 | 840 | **880** | 900 |
| Additional Land Required[c] | 0 | 0 | **15** | 35 |

(a) Required land area for handling reclaimed water flows only. Additional land area planted in a corn crop may be needed for biosolids applications.
(b) For purposes of this analysis, use the 95th percentile is recommended to develop conservative required land application areas
(c) Assumes that 790 acres and the planned additional 75 acre-expansion are available for reclaimed water irrigation.

The acreage of alfalfa shown in Table 8 was determined based on the minimum amount of alfalfa that would need to be grown to assimilate the cannery wastewater during September when cannery flows are relatively high and corn has been harvested. For the months of April through August, when both corn and alfalfa are being irrigated, it was assumed that the minimum amount of alfalfa needed for uptake in September would be planted and the remaining acreage would be planted in a corn crop. The most limited of these month, August, was used as the basis for the information in Table 8.

As mentioned above, maximizing the area planted in corn is recommended for assimilation of biosolids. However, the acreage of corn shown in Table 8 only represents the area needed to assimilate the reclaimed water; and therefore, may not be adequate to meet the biosolids requirements. The area required to be planted in corn to assimilate all biosolids at build-out conditions is discussed later in this TM.

Total Municipal Effluent Irrigation Requirements and Combined Flow Nitrogen Concentrations

The total land area and cropping assumptions described above were used to calculate the total volume of applied municipal effluent irrigation water, which can then be used to calculate the total nitrogen concentrations in the combined flows. A summary of these results is provided in Table 9.

**Table 9. Total Monthly Municipal Wastewater Irrigation Volumes (Million Gallons) and Total Nitrogen (TN) Concentrations in Combined Irrigation Flow (mg/L)**

| Month | Cannery Wastewater Concentration Percentiles | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | 50th | | 90th | | **95th[a]** | | 99th | |
| | Municipal Flow | TN | Municipal Flow | TN | **Municipal Flow** | **TN** | Municipal Flow | TN |
| April | 41.4 | 7.5 | 66.2 | 7.6 | **81.2** | **7.7** | 94.6 | 7.7 |
| May | 69.6 | 7.9 | 109.1 | 7.9 | **130.7** | **7.9** | 149.7 | 8.0 |
| June | 85.5 | 7.2 | 163.3 | 8.1 | **179.6** | **8.6** | 191.5 | 9.2 |
| July | 74.0 | 19.3 | 177.0 | 25.2 | **188.1** | **25.9** | 193.7 | 26.5 |
| August | 32.0 | 30.1 | 125.6 | 30.0 | **135.7** | **30.0** | 140.8 | 29.9 |
| September | 54.6 | 13.2 | 127.1 | 13.6 | **135.0** | **16.2** | 138.9 | 18.8 |
| October | 20.3 | 13.2 | 27.1 | 14.6 | **41.7** | **12.6** | 55.5 | 11.6 |

(a) 95th percentile recommended for use in design.

The applied nitrogen concentrations presented in Table 9 can then be compared to the allowable concentrations presented in Table 6 to assess the amount of additional nitrogen loadings that could be applied with biosolids. Biosolids applications are discussed in the next section of this TM following recycled water applications recommendations.

### Recommendations

The proposed increase in PCP cannery wastewater flows will likely result in excess field total nitrogen loadings on the City's available land application area. The amount of future required land application area is highly dependent upon the cannery wastewater total nitrogen concentration. Moreover, as described in TM #1, variations in day to day operations at the cannery will likely result in the actual field loadings exceeding the theoretical design standards that are presented above. Therefore, to be conservative, the 95$^{th}$ percentile cannery wastewater concentration is recommended for use in determining additional land area required to accommodate the potential variations in nitrogen concentrations in PCP cannery flows.

Based on the results of the analysis using the 95$^{th}$ percentile, a minimum of 355 acres should be planted in alfalfa each year to assimilate the nitrogen that will be applied late in the irrigation season from the PCP cannery flows. In order to accommodate both the cannery wastewater flows and the additional municipal effluent flows needed to dilute these flows, a total of 880 acres will need to be available for agronomic irrigation purposes during the remainder of the year. Therefore, a minimum of 15 acres of additional land is required to accommodate increases in reclaimed water irrigation flows.

As discussed previously, it was determined that winery wastewater nitrogen loads are relatively insignificant. While these flows were included in the analysis, it is evident that the cannery flows are driving the need for additional land, not the winery wastewater flows.

## BIOSOLIDS APPLICATIONS

Land application of biosolids has also been a factor with respect to historic excess nitrogen loading of the fields. Therefore, an assessment of anticipated future biosolids loading conditions was completed to determine the total land area needed to assimilate the biosolids loadings for the 2020 buildout condition. The following information is presented below with respect to additional irrigation area requirements for biosolids application:

- Biosolids Production
- Total Biosolids Nitrogen Loading Equation
- Biosolids Assumptions
- Required Biosolids Land Application Area

### Biosolids Production

A solids balance was developed for the WPCF in the Predesign Technical Memorandum #4, Predesign of Anaerobic Digestion Facilities (TM #4), which was submitted to the City in August 2002. This analysis was updated to incorporate additional data that has been collected over the past several years.

The Pre-Design TM #4 analysis biosolids loading projections were based on the typical (or actual, if available) process performance and solids characteristics for the following facilities:

- Primary Sedimentation Basins
- Secondary Solids Production
- DAFT Thickening
- Anaerobic Digesters

However, the Pre-Design TM #4 did not address solids thickening and potential reductions of solids in the WPCF biosolids lagoons. A comparison of the Pre-Design TM #4 results to the revised analysis completed for each of these facilities is presented below to incorporate these items.

Primary Sedimentation Basins

Primary sedimentation basins typically remove approximately 65 percent of the influent suspended solids from the main plant flow stream. In 2002, when Pre-Design TM #4 was developed, the influent Total Suspended Solids (TSS) loading was approximately 16,300 lb/day. However, a review of data collected in 2005 and 2006 indicates that the influent TSS loadings have decreased to 15,700 lb/day. The annual average flow during this period was approximately 6.3 mgd. Therefore, the build-out influent TSS loadings (at 8.5 mgd) are anticipated to be approximately 21,200 lb/day.

For the Pre-Design TM #4, it was assumed that the primary sedimentation basins thicken the sludge to an average concentration of 4.5 percent prior to pumping to the digesters. Data recently provided by City staff, however, show that the percent solids range from 3.3 percent to 4.5 percent, with an average of 4 percent. Therefore, for this revised assessment a percent solids of 4 percent was assumed.

Also note that the primary sedimentation basin solids flow data collected between 2003 and 2004 yielded an average flow 8,500 gpd, which would indicate a solids concentration of 11.6 percent (assuming a 65 percent capture of influent TSS). This percentage is significantly higher than what has been measured. However, after a brief period in October 2005, the flow meter readings increased significantly, averaging approximately 34,800 gallons per day. At a 65 percent capture rate, this would correlate to the loadings measured in 2005-2006 of about 4 percent. Therefore, the data collected prior to October 2005 was not used as part of this analysis.

Finally, the Pre-Design TM #4 analysis assumed that the solids stream would contain a volatile fraction of 70 percent. However, data provided by the City indicates that the volatile fraction is typically between 80 to 85 percent volatile. Therefore, an 80 percent volatile fraction was assumed for this analysis.

Secondary Solids Production

Solids production estimates from the secondary treatment systems were developed for Pre-Design TM #4 using the BioWin® model. The model assumed full nitrification, a mean cell residence time of 9.5 days, and a MLSS concentration varying from 3,000 mg/L in the summer to 4,500 mg/L in the winter. Based on this analysis, the total estimated Waste Activated Sludge (WAS) content was 7,700 pounds per day. Denitrification would not significantly affect this value; therefore, this value was used in the updated analysis.

Data provided by the City indicates that between 2001 and 2005, the average MLSS concentration was approximately 3,500 mg/L (2000 and 2006 were periods of system upset and complete nitrification were not occurring), with an estimated solids content of 0.013 percent. The City also measures the WAS flow, and between 2002 and 2005, it was approximately 85,900 gpd. The combination of these two numbers yields the estimated WAS solids content of 9,300 pounds per day, which was also used in the updated analysis.

A range between 7,700 lb/day and 9,300 lb/day range was assumed for secondary biosolids production. Similarly, the future biosolids loading range was calculated between 10,400 lb/day and 12,500 lb /day.

The secondary solids for both analyses were assumed to contain a volatile fraction of 80 percent, which is a typical value for wastewater facilities.

DAFT Thickening

All solids removed from the secondary treatment system are first sent to the dissolved air flotation thickener (DAFT) for removal of excess water prior to the digesters. Solids capture in the DAFT was assumed to be 95 percent and the thickened solids concentration was assumed to be 4.5 percent for Pre-Design TM #4, which is a typical value for wastewater facilities.

The City also currently measures thickened WAS flows. Based on data collected between 2002 and 2005, these flows were approximately 10,000 gpd. At a solids content of 4.5%, this would only be 3,700 lbs per day. Therefore, assuming influent loadings are 7,700 lbs per day, this would equate to a capture rate of 48%, which is unusually low for these types of facilities. If the loading were 9,300 lbs per day, the capture rate would be even less.

If the actual capture rate is as low as calculated, this finding will lead to major problems once these flows are re-directed from the onsite storage ponds to the aeration basins, which is planned for the City's current expansion project. Therefore, additional efforts are needed to assess the capture of the DAFT and determine if necessary improvements are required. However, low flows (near approximately 10,000 gpd) can be difficult to measure; therefore, the issue could have resulted from the flow metering. For this reason, WYA has recently requested that the City collect TSS concentration of the subnatant flows to determine whether there is significant solids content in this flow.

For purposes of this analysis, it has been assumed that the future capture rate will fall between 50 and 95%, and both values were used to represent a range of the amount of solids that are expected.

Anaerobic Digesters

Primary and thickened waste activated sludge are combined and placed in the anaerobic digesters for stabilization and solids destruction. Digesters typically achieve a 50 percent rate of destruction of the volatile solids fraction. Therefore, this amount was used for both Pre-Design TM #4 and the revised analysis.

Biosolids Lagoon

The Pre-Design TM #4 analysis did not include additional treatment and stabilization that occurs in the biosolids lagoon, which include:

- Volatile Suspended Solids (VSS) solids reduction
- Solids Thickening in Lagoon

For a lagoon that can store biosolids for approximately one year, a VSS reduction of 42 percent is typical (USEPA Process Design Manual for Sludge Treatment and Disposal). However, the WPCF biosolids lagoon retention time is significantly less than one year. Therefore, for purposes of this evaluation, it was assumed that the biosolids lagoon provided an additional VSS reduction of 30 percent because the residence time was less than one year. Assuming the sludge lagoons perform as a gravity thickener; the design solids capture percentage for the lagoon would be 85 percent (Metcalf & Eddy, 2004).

Using the solids production estimating assumptions described above, the historical volume of solids that would have been land applied would be approximately 1,100 dry tons per year. However, as shown in Table 10, the reported historic volumes between 2002 and 2006 were approximately 605 tons per year, which is a substantially lower value. This data suggests that the existing solids capture rate in the lagoon is only approximately 49 percent.

**Table 10. Reported Annual Biosolids Land Application Quantity**

| Year | Biosolids Application, Tons/year |
|---|---|
| 2002 | 725 |
| 2003 | 690 |
| 2004 | 580 |
| 2005 | 550 |
| 2006 | 478 |
| Average | 605 |

All digested sludge is currently discharged to Sludge Lagoon No. 2. The capacity of this lagoon is not sufficient for the existing or anticipated future liquid volume of biosolids. This lagoon has an available storage volume of approximately 1.9 million gallons. At a projected production of approximately 70,000 gallons of digested sludge per day, the average storage capacity is about 27 days.

Moreover, based on discussions with City staff, there is approximately one to two feet of stored solids that cannot be removed from the bottom of the lagoon using pumping equipment. The City staff also cannot use alternative equipment to empty the lagoon because there is no other place to put the solids while the lagoon is being cleaned. Therefore, the actual holding capacity of the lagoon is even less than 1.9 million gallons. Combined with the information presented above, it can be concluded that the existing lagoon volume is not sufficient.

The solids that cannot be retained in Lagoon No. 2 are currently flowing either to the storage ponds or directly to the land application area without the oversight required under State and Federal regulations. Moreover, the City is planning to construct a lagoon supernatant return flow pump station, which would direct the flows that cannot be held within Lagoon No. 2 to the aeration basins. Because there are too many solids currently in the supernatant flow stream to introduce it into the main plant treatment train, it would not be prudent to use this return pump station until this issue resolved.

For purposes of this analysis, it has been assumed that additional biosolids storage capacity will be constructed in the future. Following the completion of this project, the capture rate in the lagoons would range from 85 to 95 percent. However, for purposes of this analysis, a theoretical lagoon capture rate of 100 percent was used. Note that these capture rates are similar to what would be expected for a dewatering facility.

Summary of Solids Production Scenarios

Using this updated information discussed above, a solids balance was developed to quantify biosolids production under different scenarios. Scenario 1 assumes a DAFT solids recovery of 50 percent, while Scenarios 2 and 3 have a 95 percent DAFT solids recovery. Scenarios 1 and 2 assume 30% VSS reduction in the Lagoons and a solids capture rate of 85 percent, while Scenario 3 assumes no VSS reduction and a Lagoon solids capture of 100 percent. The scenarios developed also represent the range of WAS production, and actual production will fall somewhere between these two values. Scenarios that include an "a" designation refer to the WAS production of existing: 7,700 lb/day, future: 10,400 lb/day), while Scenarios that include a "b" designation refer to WAS production estimate of existing: 9,300 lb/day, future: 12,500 lb/day. A summary of the various scenarios evaluated for the current and future conditions is provided as follows:

- **Scenario 1a**. WAS Flow of 7,700 (existing) and 10,400 (future) pounds per day, 50% DAFT Solids Recovery, 30% VSS Reduction in Lagoons, 85% Solids Capture in Lagoon
- **Scenario 2a**. WAS Flow of 7,700 (existing) and 10,400 (future) pounds per day, 95% DAFT Solids Recovery, 30% VSS Reduction in Lagoons, 85% Solids Capture

- **Scenario 3a**. WAS Flow of 7,700 (existing) and 10,400 (future) pounds per day, 95% DAFT Solids Recovery, No VSS Reduction Following Digesters, 100% Solids Capture in the Lagoon
- **Scenario 1b**. WAS Flow of 9,300 (existing) and 12,500 (future) pounds per day, 50% DAFT Solids Recovery, 30% VSS Reduction in Lagoons, 85% Solids Capture in Lagoon
- **Scenario 2b**. WAS Flow of 9,300 (existing) and 12,500 (future) pounds per day, 95% DAFT Solids Recovery, 30% VSS Reduction in Lagoons, 85% Solids Capture
- **Scenario 3b**. WAS Flow of 9,300 (existing) and 12,500 (future) pounds per day, 95% DAFT Solids Recovery, No VSS Reduction Following Digesters, 100% Solids Capture in the Lagoon

A summary of the biosolids loading assumptions and biosolids production is provided in Table 11. Please note that ranges of biosolids production are provided under each scenario, bracketing the ranges of WAS production discussed previously. Also note that Scenarios 3a and 3b represents a worst-case condition, and would represent the total amount of solids coming from the anaerobic digesters. Actual biosolids production is anticipated to fall in between the values shown for the three scenarios.

As shown in Table 11, a large range of biosolids production is possible. However, Scenarios 2a and 2b represents the typical "design" operating range for the WPCF facilities. Therefore, this scenario is the recommended design scenario for determining the amount of land required to assimilate biosolids at agronomic rates.

**Table 11. Biosolids Loading Assumptions and Average Daily Biosolids Production**

| Item | Scenario 1a | Scenario 1b | **Scenario 2a** | **Scenario 2b** | Scenario 3a | Scenario 3b |
|---|---|---|---|---|---|---|
| DAFT Solids Recovery, percent | 50 | 50 | **95** | **95** | 95 | 95 |
| Solids Capture in Lagoon, percent | 85 | 85 | **85** | **85** | 100 | 100 |
| Current (2006) Biosolids Production, tons/year [(a)] | 1,100 | 1,100 | **1,300** | **1,400** | 1,900 | 2,100 |
| Future (2020) Biosolids Production, tons/year [(b)] | 1,400 | 1,500 | **1,800** | **1,900** | 2,600 | 2,800 |

(a) Current loadings were based on secondary WAS solids production ranging between 7,700 and 9,300 lb/day and an influent TSS loading of 15,700 lb/day.
(b) Future loadings were based on secondary WAS solids production ranging between 10,400 and 12,500 lb/day and an influent TSS loading of 21,200 lb/day.

**Total Biosolids Nitrogen Loading Equation**

Total biosolids nitrogen loading is comprised of two sources of nitrogen, one from biosolids applied during the current year, and one from mineralized organic nitrogen that becomes available over time. In the USEPA Process Design Manual for Land Application of Sewage Sludge and Municipal Septage (1995), total nitrogen (N) loading is defined as follows:

**Total N Loading = Plant Available Nitrogen (PAN) + Mineralized Organic Nitrogen (MON)**

(Equation 2)

Plant Available Nitrogen (PAN) is determined using the following equation:

**PAN= (Nitrate + kv*Ammonia + fn*Organic Nitrogen)**

(Equation 3)

Where:

Nitrate = Applied Biosolids Nitrate Concentration on a dry weight basis

kv = volatilization fraction, 0.5 for anaerobically digested biosolids and surface spreading

Ammonia = Applied Biosolids Ammonia Concentration on a dry weight basis

fn = fraction of organic nitrogen available during the first year of application, 0.2 for anaerobically digested biosolids

Organic Nitrogen = Applied Biosolids Organic Nitrogen Concentration on a dry weight basis

Mineralized Organic Nitrogen (MON) is defined as the amount of organic nitrogen (ON) that is available during the current year that has been mineralized over the past three years. For purposes of this evaluation, the year 2006 (representing the current year loading) has been provided to clarify the varying fractions of ON that become available over time. The MON equation is computed as follows:

**Mineralized Organic Nitrogen (MON) (Year 2006) = 0.2 * ON (Year 2005) + 0.1 * ON (Year 2004) + 0.05 * ON (Year 2003)**

(Equation 4)

Where:

20% of the applied ON is mineralized (becomes available) during the first year following application, for anaerobically digested sludge

10% of the applied ON is mineralized during the second year following application, for anaerobically digested sludge

5% of the applied ON is mineralized during the third year following application, for anaerobically digested sludge

**Biosolids Assumptions**

The following assumptions were used in developing the additional land application requirements for biosolids application:

- The future biosolids nitrogen concentration would be equivalent to the historic average biosolids nitrogen concentrations from 2000-2006, as shown in Table 12:

**Table 12. Historic Annual Average Nitrogen Concentrations**

| Constituent | Concentration, Dry Weight Basis, mg/kg |
|---|---|
| Nitrate | 0 |
| Ammonia | 37,800 |
| Organic Nitrogen | 39,100 |

Note that the City has been measuring nitrogen concentrations of the biosolids entering Lagoon #2. Therefore, actual nitrogen concentrations may be lower than the average values represented in Table 12. However, these values were used for purposes of developing a conservative analysis.

- Biosolids nitrogen can be assimilated during the winter months when wheat (or a similar winter crop) is grown and by the remaining uptake available for a summer corn crop (determined based on theoretical irrigation water loadings discussed above), as shown in Table 13:

**Table 13. Assumed Crop Nitrogen Loading Requirements**

| Crop | Nitrogen Loading, lb/ac |
|---|---|
| Wheat Component | 171 |
| Available Corn Component | 92 |
| Total Wheat/Corn | 263 |

### Required Biosolids Land Application Area

Depending on the biosolids design criteria, a varying range of land is required for existing and future biosolids land application. Table 14 presents the biosolids required land application area for each scenario.

**Table 14. Existing and Future Biosolids Application Conditions**

| Item | Historical Average Conditions | Scenario 1a | Scenario 1b | **Scenario 2a [a]** | **Scenario 2b [a]** | Scenario 3a | Scenario 3b |
|---|---|---|---|---|---|---|---|
| Existing Conditions | | | | | | | |
| Design Dry Solids [b] | 605 | 1,100 | 1,100 | **1,300** | **1,400** | 1,900 | 2,100 |
| Total N Loading, Lb/year | 58,300 | 106,100 | 106,100 | **125,400** | **135,100** | 144,700 | 202,600 |
| Required Land Area of Corn, ac | 220 | 400 | 400 | **475** | **510** | 545 | 765 |
| Future Conditions | | | | | | | |
| Design Dry Solids [c] | — | 1,400 | 1,500 | **1800** | **1900** | 2600 | 2800 |
| Total N Loading, Lb/year | — | 135,100 | 144,700 | **173,700** | **183,300** | 250,900 | 270,200 |
| Required Land Area of Corn, ac | — | 510 | 545 | **655** | **690** | 945 | 1,020 |

(a) Recommended design scenarios.
(b) Current loadings were based on WAS secondary solids production of 7,000-9,300 lb/day and influent TSS loading of 15,700 lb/day.
(c) Future loadings were based on secondary WAS solids production of 10,400-12,500 lb/day and influent TSS loading of 21,200 lb/day.

Note that historical average conditions are significantly less than both existing and the anticipated future conditions as well. As discussed previously, this is attributed to the loss of solids in the storage ponds. As shown in Table 14, a much larger acreage of corn is required than previously has been used for biosolids application.

## TOTAL LAND AREA REQUIREMENTS SUMMARY

The total amount of land required is determined by combining land requirements for both reclaimed water and biosolids application under current and future conditions. Land area requirements for existing conditions and future conditions are provided in Table 15.

**Table 15. Current and Future Land Area Requirements for Reclaimed Water and Biosolids Application [a]**

| Crop | Condition | Current Land Area Requirements, acres | Future Land Area Requirements, acres |
|---|---|---|---|
| Alfalfa | Required for Reclaimed Water Application (Refer to Table 8) | 355 | 355 |
| Corn/Wheat | Required for Reclaimed Water Application (Refer to Table 8) | 525 | 525 |
| | Required for Biosolids Application (Refer to Table 14) | 475 – 510 | 655 – 690 |
| | Area Required [b] | 525 | 690 |
| Total Required Land Area | | 880 | 1045 |
| Additional Area Required [c] | | 15 | 180 |

(a) This is the total amount of land area required to assimilate both reclaimed water and biosolids during land application. Because the biosolids required land area is greater than the reclaimed water area required for corn, no additional corn acreage is needed to assimilate reclaimed water.
(b) Maximum of the calculated required values.
(c) Assuming that 790 acres and the planned additional 75 acre expansion are available for combined reclaimed water irrigation. Note that the City does currently own an additional 15 acre field in the proposed expansion area.

## EXISTING AND FUTURE TOTAL LOADING CONDITIONS

Historically, nitrogen loadings have typically been the most regulated constituent with respect to land application of industrial flows such as cannery and winery wastewater. However, other constituents such as Total Dissolved Solids (TDS) and Biological Oxygen Demand (BOD) are also of concern and should be considered during design of land application systems. Existing and future concentration and flow conditions for the following constituents are described as follows:

- Total Nitrogen
- Biological Oxygen Demand
- Total Dissolved Solids

Total Nitrogen

A summary of the current and projected average flow conditions and projected flow weighted concentrations of the projected reclaimed water quality on an annual basis is presented in Table 16.

**Table 16. Projected Maximum Reclaimed Water Total Nitrogen Flow-Weighted Average Concentration (Annual Basis)**

| TN Source | Historic TN Concentrations mg/L [a] | Projected Future TN Concentrations mg/L [b] | Historical Average Flow, MG per year [c] | Current Average Flow (865 acres) [d], MG per year | 2020 Projected Flow (1,045 acres) [e], MG per year |
|---|---|---|---|---|---|
| Municipal Effluent to Land | 23 | 8 | 763 | 755 | 1,012 |
| PCP Cannery | 78 | 78 | 115 | 260 | 260 |
| Winery Wastewater | 42 | 42 | 0.13 | 2.5 | 2.5 |
| Industrial Line Winter Runoff | 3 [f] | 3 | 154 | 154 | 154 |
| Onsite Winter Runoff | 20 [f] | 20 | 46 | 46 | 46 |
| Other Industries | 11 [f] | 11 | 16 | 16 | 16 |
| Estimated Biosolids Supernatant | 1,290 [g] | — | 3 | 0 [i] | 0 [i] |
| DAFT Subnatant | 23 [h] | — | 29 | 0 [i] | 0 [i] |
| Total | | — | 1,126 | 1,233 | 1,490 |
| Flow Weighted Average Nitrogen Concentration, mg/L | — | — | 29.0 | 22.7 | 20.1 |

(a) Historic TN concentrations are averages between 2002 through 2005, with the exception of PCP cannery and winery wastewater, which are maximum concentrations.
(b) Projected future concentrations are expected to remain the same, except for municipal effluent.
(c) Average of reclaimed water flows from 2002 through 2005.
(d) Includes flow requirements for 865 acres of land.
(e) Includes flow requirements for 1,045 acres of land based on recommendations discussed above.
(f) Obtained from industrial discharge data between 2002 and 2005. To be eliminated from land application in the future.
(g) Obtained from standard minerals sampling 2005-2006. To be eliminated from land application in the future.
(h) Assumed to be equal to the reclaimed water TN concentration.
(i) Supernatant and subnatant will be routed to the aeration basins. These flows will be offset by municipal effluent.

As shown in Table 16, the addition of land application area results in a reduction in the applied total nitrogen concentration due to the dilution provided by blending municipal effluent. The addition of 75 acres would reduce the average TN concentration from 29.0 to 22.7 mg/L. The addition of 255 acres would result in a TN reduction to 20.1 mg/L.

**Total Dissolved Solids**

Total Dissolved Solids (TDS) in the reclaimed water or biosolids can increase groundwater TDS concentrations. This should be avoided because groundwater TDS concentrations are already greater than established TDS water quality criteria. Therefore, current and future TDS loading rates associated with recycled water applications are addressed below.

The major contributor of TDS is the PCP cannery. As discussed in the City's Groundwater Investigation Existing Conditions Report, approximately half of the annual TDS load to the irrigation area originates from the PCP cannery. However, cannery wastewater has unique characteristics with respect to TDS. Dissolved solids consist of both volatile (organic) dissolved solids (VDS) and fixed (inorganic) dissolved solids (FDS). Cannery wastewater is typically comprised of a significant amount of VDS, which are labile (readily break down following land application) and therefore do not pose a threat to groundwater. Nevertheless, adequate FDS data is not available to evaluate the historic flow-weighted FDS concentrations. Therefore, the projected total dissolved solids concentration is based on TDS data.

The projected maximum flow-weighted reclaimed water TDS concentrations for the City's reclaimed water discharge are presented in Table 17. This calculation incorporates all of the flow sources discharged to the irrigation area.

**Table 17. Projected Maximum Reclaimed Water Total Dissolved Solids Concentration**

| TDS Source | Historic TDS Concentrations mg/L [a] | Existing Average Flow, MG per year [b] | Current Average Flow (865 acres) [c], MG per year | 2020 Projected Flow (1,045 acres) [d], MG per year |
|---|---|---|---|---|
| Municipal Effluent to Land | 424 | 763 | 755 | 1,012 |
| PCP Cannery | 2,150 [e] | 115 | 260 | 260 |
| Winery Wastewater | 2,353 [f] | 0.13 | 2.5 | 2.5 |
| Industrial Line Winter Runoff | 420 [g] | 154 | 154 | 154 |
| Onsite Winter Runoff | 420 [g] | 46 | 46 | 46 |
| Other Industries | 420 [g] | 16 | 16 | 16 |
| Estimated Biosolids Supernatant | 2,000 [g] | 3 | 0 [i] | 0 [i] |
| DAFT Subnatant | 424 [h] | 29 | 0 [i] | 0 [i] |
| Total | — | 1,126 | 1,233 | 1,490 |
| Projected Maximum Flow-Weighted TDS Concentration, mg/L | — | 604 | 791 | 728 |

(a) Historic TDS concentrations are averages between 2000 through 2006, with the exception of PCP cannery and winery wastewater.
(b) Average of reclaimed water flows from 2002 through 2005.
(c) Includes flow requirements for 865 acres of land.
(d) Includes flow requirements for 1,045 acres of land based on recommendations discussed above.
(e) Cannery concentration calibrated based on average reclaimed water TDS concentrations.
(f) Annual average from 2006.
(g) Obtained from industrial discharge data between 2002 and 2005.
(h) Assumed to be equal to the municipal TDS concentration.
(i) Supernatant and subnatant will be routed to the aeration basins. Additional flow will be provided by domestic effluent.

As shown in Table 17, even with the additional land application area, the TDS concentration will increase due to the additional cannery flows. However, as described above, a significant portion of the applied TDS will readily breakdown prior to or shortly after, land application. Based on the limited standard minerals data collected during the 2005 and 2006 canning season, between 35 and 71 percent (54 percent average) of the TDS concentration is volatile and will readily break down. During non-canning periods, the percentage is negligible. Therefore, assuming an average of 50 percent reduction of cannery TDS, the 2020 buildout TDS concentration of 728 mg/L would be approximately 540 mg/L of TDS would be land applied. Additional data will be collected to provide additional data support for this finding, and future TDS concentrations will be confirmed by PCP cannery.

**Biological Oxygen Demand (BOD)**

Following land application, biological oxygen demand (BOD) is removed through the soil profile through filtration, adsorption, and biological reduction and oxidation. The consideration of BOD loading is important because excess organic loading during land application can result in odorous anaerobic conditions, incomplete removal of organics in the soil profile, mobilization of iron, manganese, and other compounds, as well as increases in bicarbonate in the soil solution via carbon dioxide dissolution (CLFP, 2007).

The projected maximum reclaimed water BOD concentration is presented in Table 18. This calculation incorporates all of the flow sources that are discharged to the irrigation area.

**Table 18. Projected Maximum Reclaimed Water Biological Oxygen Demand Concentration**

| BOD Source | Historic BOD Concentrations mg/L | Existing Average Flow, MG per year [a] | Current Average Flow (865 acres) [b], MG per year | 2020 Projected Flow (1,045 acres) [c], MG per year |
|---|---|---|---|---|
| Municipal Effluent to Land | 7 [d] | 763 | 755 | 1,012 |
| PCP Cannery | 3,779 [e] | 115 | 260 | 260 |
| Winery Wastewater | 3,297 [f] | 0.13 | 2.5 | 2.5 |
| Industrial Line Winter Runoff | 69 [g] | 154 | 154 | 154 |
| Onsite Winter Runoff | 420 [g] | 46 | 46 | 46 |
| Other Industries | 69 [g] | 16 | 16 | 16 |
| Estimated Biosolids Supernatant | 4,000 [h] | 3 | 0 [j] | 0 [j] |
| DAFT Subnatant | 7 [i] | 29 | 0 [j] | 0 [j] |
| Total | — | 1,126 | 1,233 | 1,490 |
| Projected Maximum Flow-Weighted BOD Concentration, mg/L | — | 429 | 833 | 691 |

(a) Average of reclaimed water flows from 2002 through 2005.
(b) Includes flow requirements for 865 acres of land.
(c) Includes flow requirements for 1,045 acres of land.
(d) Average effluent BOD between 2000 through 2006.
(e) Maximum annual average between 1999 and 2006.
(f) Annual average from 2006.
(g) 99th percentile historical industrial influent BOD concentration during the non canning season (2000-2005).
(h) Estimated value.
(i) Assumed to be equal to the municipal effluent BOD concentration.
(j) Supernatant and subnatant will be routed to the aeration basins. Additional flow will be provided by municipal effluent.

As shown in Table 18, BOD loadings are also expected to increase as a result of the increased cannery flows. Similar to the TDS concentrations, however, BOD from the cannery will be exerted prior to or shortly after land application. Additional data will be collected regarding reclaimed water BOD. Following collection of additional data, the BOD loading rates will be revisited and incorporated into design loadings. Furthermore, cannery wastewater pretreatment is being evaluated, which would result in additional BOD reduction.

The following calculations demonstrate the historic BOD field loading rates based on data collected by the City. Table 19 illustrates the historic BOD field loading.

**Table 19. Historic BOD Field Loading**

| Year | Average Annual Industrial BOD Field Loading, lb/ acre/year[(a)] | Average Annual Municipal BOD Field Loading, lb/ acre/year[(a)] |
|---|---|---|
| 2000 | 8,119 | 23 |
| 2001 | 9,112 | 40 |
| 2002 | 4,607 | 48 |
| 2003 | 3,535 | 52 |
| 2004 | 2,997 | 50 |
| 2005 | 3,496 | 29 |

(a) Annual loads were determined from BOD concentration data collected weekly and daily flow data. Note the municipal BOD load is only based on the portion directed to the storage ponds.

As shown in the above table, the vast majority of the BOD load to the City's irrigation area is from the industrial flow (primarily from the PCP cannery), which is typically discharged between July and September. These flows are blended with the treated municipal wastewater prior to being land applied. Note that BOD loads associated with the other sources of irrigation water are also expected to be very low in comparison to these industrial loads.

As shown in Table 19, the loads from the PCP cannery were substantially greater during 2000 and 2001. These two years are more representative of projected future conditions, as cannery flows during 2000 and 2001 were roughly double the current flows. Therefore, the loadings that occurred in these two years are representative of the anticipated future BOD loading rates and will be used to develop BOD design criteria. Future BOD concentrations will be confirmed by PCP cannery.

In summary, because total nitrogen has historically been regulated as the limiting constituent for land application design, total nitrogen concentrations and flows are used to size additional land area requirements for both reclaimed water and biosolids. However, after additional data collection, TDS and BOD loadings will be revisited to determine if additional area would be required to assimilate these constituents. Finally, pretreatment of cannery wastewater is currently being considered, which would result in reductions of TN, TDS and BOD loadings.

MAC:nmp

# APPENDIX A

## Nitrogen Contributions and Totals of Applied Reclaimed Water

## Appendix A: Nitrogen Contributions and Totals of Applied Reclaimed Water

Table A-1. Flows and Concentrations for Land Application (50th Percentile Cannery Concentrations)

| | Domestic Flow | | | Cannery Flow | | | Winery Wastewater | | | Total RW Flow, MG | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Flow[1], MG | Total Nitrogen Conc., mg/L | Load, lb/month | Flow[1], MG | Total Nitrogen Conc., mg/L | Load, lb/month | Flow[1], MG | Total Nitrogen Conc., mg/L | Load, lb/month | Flow[1], MG | Total Nitrogen Conc., mg/L | Load, lb/month | Total Field Area Crop Uptake [2] |
| Apr | 41.4 | 8.0 | 2,765 | 5.2 | 2.2 | 96 | 0.1 | 42.0 | 50 | 46.8 | 7.5 | 2,912 | 10,808 |
| May | 69.6 | 8.0 | 4,645 | 2.0 | 3.4 | 57 | 0.1 | 42.0 | 22 | 71.7 | 7.9 | 4,724 | 15,580 |
| June | 85.5 | 8.0 | 5,703 | 23.0 | 4.1 | 797 | 0.2 | 42.0 | 53 | 108.7 | 7.2 | 6,552 | 27,368 |
| July | 74.0 | 8.0 | 4,936 | 56.6 | 33.9 | 15,975 | 0.3 | 42.0 | 92 | 130.8 | 19.3 | 21,003 | 35,724 |
| Aug | 32.0 | 8.0 | 2,133 | 86.6 | 38.2 | 27,613 | 0.4 | 42.0 | 125 | 118.9 | 30.1 | 29,871 | 34,662 |
| Sept | 0.7 | 8.0 | 46 | 37.4 | 20.7 | 6,458 | 0.2 | 42.0 | 62 | 38.2 | 20.6 | 6,566 | 9,885 |
| Oct | 18.3 | 8.0 | 1,219 | 5.2 | 32.2 | 1,403 | 0.2 | 42.0 | 79 | 23.7 | 13.7 | 2,701 | 5,999 |

(1) Note that the domestic effluent flow increases as cannery concentration increases in order to reduce the total RW concentration.
(2) Total field nitrogen uptake rate based on 195 acres of alfala and 275 acres of corn, for a total of 470 acres.

Table A-2. Flows and Concentrations for Land Application (90th Percentile Cannery Concentrations)

| | Domestic Flows | | | Cannery Flow | | | Winery Wastewater | | | Total RW Flow, MG | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Flow[1], MG | Total Nitrogen Conc., mg/L | Load, lb/month | Flow[1], MG | Total Nitrogen Conc., mg/L | Load, lb/month | Flow[1], MG | Total Nitrogen Conc., mg/L | Load, lb/month | Flow[1], MG | Total Nitrogen Conc., mg/L | Load, lb/month | Total Field Area Crop Uptake [2] |
| Apr | 66.2 | 8.0 | 4,416 | 5.2 | 2.2 | 96 | 0.1 | 42.0 | 50 | 71.5 | 7.6 | 4,563 | 16,070 |
| May | 109.1 | 8.0 | 7,278 | 2.0 | 3.4 | 57 | 0.1 | 42.0 | 22 | 111.1 | 7.9 | 7,356 | 23,288 |
| June | 163.3 | 8.0 | 10,895 | 23.0 | 8.6 | 1,644 | 0.2 | 42.0 | 53 | 186.5 | 8.1 | 12,592 | 45,538 |
| July | 177.0 | 8.0 | 11,807 | 56.6 | 78.9 | 37,201 | 0.3 | 42.0 | 92 | 233.8 | 25.2 | 49,101 | 60,595 |
| Aug | 125.6 | 8.0 | 8,380 | 86.6 | 61.7 | 44,596 | 0.4 | 42.0 | 125 | 212.6 | 30.0 | 53,101 | 57,002 |
| Sept | 7.5 | 8.0 | 503 | 37.4 | 32.4 | 10,109 | 0.2 | 42.0 | 62 | 45.1 | 28.4 | 10,674 | 11,091 |
| Oct | 22.5 | 8.0 | 1,503 | 5.2 | 47.9 | 2,089 | 0.2 | 42.0 | 79 | 28.0 | 15.7 | 3,671 | 6,989 |

(1) Note that the domestic effluent flow increases as cannery concentration increases in order to reduce the total RW concentration.
(2) Total field nitrogen uptake rate based on 230 acres of alfala and 610 acres of corn, for a total of 840 acres.

Table A-3. Flows and Concentrations for Land Application (95th Percentile Cannery Concentrations)

| | Domestic Flows | | | Cannery Flow | | | Winery Wastewater | | | Total RW Flow, MG | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Flow[1], MG | Total Nitrogen Conc., mg/L | Load, lb/month | Flow[1], MG | Total Nitrogen Conc., mg/L | Load, lb/month | Flow[1], MG | Total Nitrogen Conc., mg/L | Load, lb/month | Flow[1], MG | Total Nitrogen Conc., mg/L | Load, lb/month | Total Field Area Crop Uptake [2] |
| Apr | 81.2 | 8.0 | 5,419 | 5.2 | 2.2 | 96 | 0.1 | 42.0 | 50 | 86.6 | 7.7 | 5,565 | 19,959 |
| May | 130.7 | 8.0 | 8,720 | 2.0 | 3.4 | 57 | 0.1 | 42.0 | 22 | 132.7 | 7.9 | 8,799 | 28,783 |
| June | 179.6 | 8.0 | 11,983 | 23.0 | 12.7 | 2,436 | 0.2 | 42.0 | 53 | 202.8 | 8.6 | 14,472 | 49,762 |
| July | 188.1 | 8.0 | 12,550 | 56.6 | 85.3 | 40,238 | 0.3 | 42.0 | 92 | 244.9 | 25.9 | 52,881 | 63,448 |
| Aug | 135.7 | 8.0 | 9,056 | 86.6 | 64.3 | 46,478 | 0.4 | 42.0 | 125 | 222.7 | 30.0 | 55,658 | 59,686 |
| Sept | 32.0 | 8.0 | 2,138 | 37.4 | 45.8 | 14,262 | 0.2 | 42.0 | 62 | 69.6 | 28.4 | 16,463 | 17,119 |
| Oct | 37.7 | 8.0 | 2,517 | 5.2 | 48.2 | 2,101 | 0.2 | 42.0 | 79 | 43.2 | 13.0 | 4,698 | 10,787 |

(1) Note that the domestic effluent flow increases as cannery concentration increases in order to reduce the total RW concentration.
(2) Total field nitrogen uptake rate based on 355 acres of alfala and 525 acres of corn, for a total of 880 acres.

Table A-4. Flows and Concentrations for Land Application (99th Percentile Cannery Concentrations)

| | Domestic Flows | | | Cannery Flow | | | Winery Wastewater | | | Total RW Flow, MG | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Flow[1], MG | Total Nitrogen Conc., mg/L | Load, lb/month | Flow[1], MG | Total Nitrogen Conc., mg/L | Load, lb/month | Flow[1], MG | Total Nitrogen Conc., mg/L | Load, lb/month | Flow[1], MG | Total Nitrogen Conc., mg/L | Load, lb/month | Total Field Area Crop Uptake [2] |
| Apr | 94.6 | 8.0 | 6,310 | 5.2 | 2.2 | 96 | 0.1 | 42.0 | 50 | 99.9 | 7.7 | 6,457 | 23,479 |
| May | 149.7 | 8.0 | 9,990 | 2.0 | 3.4 | 57 | 0.1 | 42.0 | 22 | 151.8 | 8.0 | 10,069 | 33,742 |
| June | 191.5 | 8.0 | 12,778 | 23.0 | 18.5 | 3,563 | 0.2 | 42.0 | 53 | 214.7 | 9.2 | 16,393 | 52,911 |
| July | 193.7 | 8.0 | 12,921 | 56.6 | 89.9 | 42,391 | 0.3 | 42.0 | 92 | 250.5 | 26.5 | 55,405 | 64,859 |
| Aug | 140.8 | 8.0 | 9,394 | 86.6 | 65.4 | 47,264 | 0.4 | 42.0 | 125 | 227.8 | 29.9 | 56,782 | 61,013 |
| Sept | 55.6 | 8.0 | 3,708 | 37.4 | 58.8 | 18,308 | 0.2 | 42.0 | 62 | 93.1 | 28.4 | 22,078 | 22,906 |
| Oct | 52.3 | 8.0 | 3,491 | 5.2 | 48.4 | 2,111 | 0.2 | 42.0 | 79 | 57.8 | 11.8 | 5,681 | 14,433 |

(1) Note that the domestic effluent flow increases as cannery concentration increases in order to reduce the total RW concentration.
(2) Total field nitrogen uptake rate based on 475 acres of alfala and 425 acres of corn, for a total of 900 acres.

# Appendix I City of Lodi Water Recycling Facilities Planning Grant Application

# City of Lodi Water Recycling Facilities Planning Grant Application

For consideration in the Water Recycling Funding Program offered by
State Water Resources Control Board
Division of Financial Assistance

**Prepared by:**
RMC
Water and Environment

**September 20, 2006**

# Attachment 1 – Plan of Study

# City of Lodi
# Recycled Water Master Plan
# Planning Study Grant Application

## Introduction

The City of Lodi (City) currently recycles about 35% of treated effluent in the summer months for feed crop irrigation and in pond recharge. The City is interested in preparing a Recycled Water Master Plan (RWMP) to assess the full recycled water market potential within the current City limits as well as future areas of development, and to identify cost-effective alternatives for implementation. Implementation of recycled water would provide several benefits to the City, including:

- **Offset Groundwater Pumping.** The City currently uses groundwater from the San Joaquin Valley groundwater basin for all demands. The Department of Water Resources (DWR) has declared that the groundwater basin underlying Eastern San Joaquin County is overdrafted, and groundwater levels in the County and the City are generally decreasing (DWR, Bulletin 118). Expanding the use of recycled water to serve non-potable demands would offset the use of groundwater supplies, thereby addressing some of the overdraft issues.
- **Improve Supply Reliability.** The City's water demand is projected to more than double between 2005 and 2040; therefore a reliable alternative supply source is needed. Recycled water supply serving non-potable demands for the City is considered to be very consistent even in dry years; and resistant to supply fluctuations in comparison to groundwater. The use of recycled water will reduce dependency on potable water supplies for non-potable uses, and in turn preserves potable supplies for highest uses (e.g. drinking water).
- **Utilize Tertiary Treated Wastewater.** All wastewater (except for the 2.1 mgd feed crop irrigation) is tertiary treated at the White Slough Water Pollution Control Facility (WSWPCF) to meet Title 22 standards. The 7 mgd wastewater treatment plant is sized to accommodate additional recycled water demands, and the City would benefit by finding a market for the surplus tertiary treated water.
- **Reduce Effluent Discharges.** Increased water recycling reduces the amount of effluent discharged into White Slough.

## Plan of Study

The following sections present the Plan of Study, and are organized in accordance with the State's "Water Recycling Funding Program Guidelines" dated October 2004.

### 1. Recycled Water Service Area

The recycled water service area that will be evaluated by the RWMP includes the City of Lodi, the WSWPCF, as well as new development areas located west of the City (between the City and WSWPCF) as shown in Figure 1. Lodi's geographical area extends from the Mokelumne River on the north, Woodbridge Irrigation District's South Main Canal and Lower Sacramento Road on the west, Harney Lane on the south, and portions of Highway 99 and Central California Traction Railroad on the east. The new development area boundaries are Highway 12 to the north, Ray Road to the west, halfway between Armstrong Road and Harney Road to the south and the eastern City limit to the east.

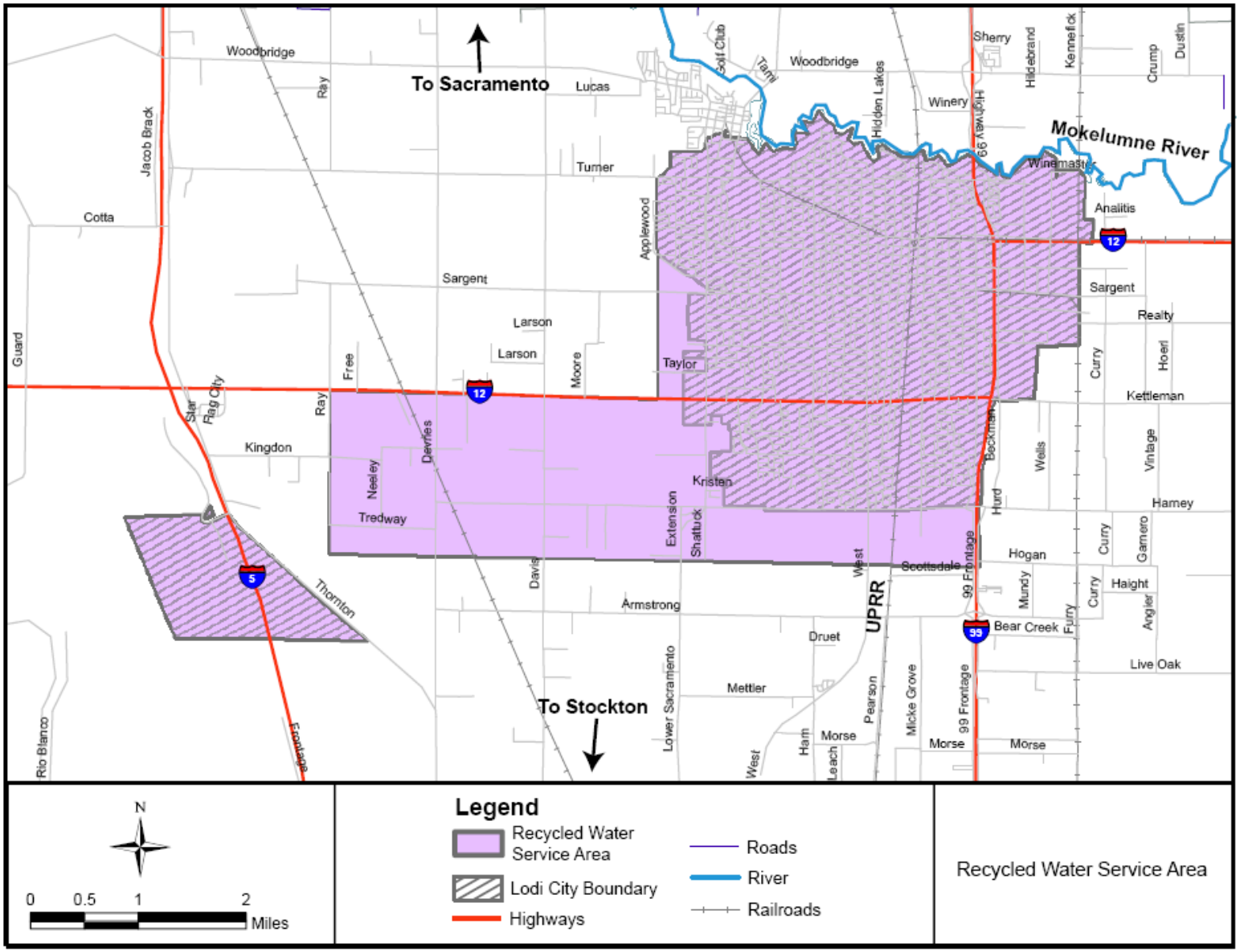



**Figure 1: City of Lodi Recycled Water Service Area**

## 2. Recycled Water Sources and Unit Process Summary at the Existing Treatment Facility

The main source of recycled water is the White Slough Water Pollution Control Facility located approximately 6 miles southwest of the City. All of the wastewater collected within the City limits undergoes tertiary treatment. The effluent produced meets Title 22 recycled water standards. Currently, the WSWPCF is permitted for a capacity of 7.0 million gallons per day (mgd), with an average daily flow in 2004-2005 being 6.4 mgd. (RMC, 2006)

Wastewater at the WSWPCF is treated by the following treatment train as seen in Figure 2.

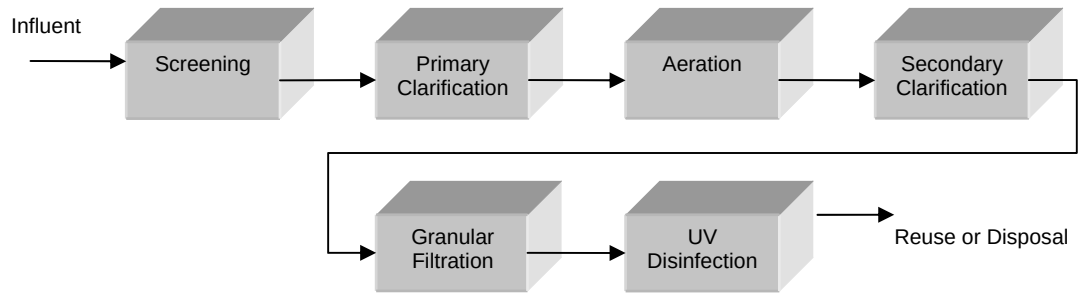



Figure 2: Existing Wastewater Treatment Flow Schematic

Primary Treatment

- Influent screening;
- Grinding;
- Grit removal;
- Primary clarification;

Secondary Treatment

- Aeration/sludge activation;
- Secondary clarification;
- WAS thickening;
- Anaerobic digestion of solids;

Tertiary Treatment

- Granular filtration;
- UV disinfection;
- Effluent flow measurement; and
- Effluent disposal or reuse.

## 3. Current Disposal and Reuse

An average wastewater flow of 6.4 mgd is generated at the WSWPCF. Effluent not recycled in the summer months is tertiary treated and discharged into White Slough, which is part of the San Joaquin Delta. During the winter months, all treated effluent is discharged to White Slough.

Approximately 2.09 mgd or 35% of the treated effluent from WSWPCF is recycled in the summer months by the following methods:

- The City leases 650 acres of land near WSWPCF to farmers for the cultivation and harvesting of feed and fodder crops not intended for human consumption. This land is irrigated with secondary treated wastewater from the WSWPCF.
- City has also supplied tertiary treated recycled water from WSWPCF to produce steam for a 49-megawatt natural gas-powered generator and to replenish mosquito fish-rearing ponds
- The City has provided a "will-serve" letter to supply 1 mgd of tertiary treated wastewater to the Northern California Power Agency to use at a potential power plant

## 4. Study Area Map

The boundaries of the planning area and the location of the WSWPCF, the source of recycled water, are illustrated in Figure 1.

## 5. Agency Jurisdiction

The City of Lodi Water Utility (Utility) is the sole water supplier for the City of Lodi and currently serves 62,500 people. The Utility's service area is contiguous with the City boundaries and covers approximately 12 square miles. The City owns, operates, and maintains the wastewater system that serves the City. Woodbridge Irrigation District has jurisdiction over portions of the new development area; however has no jurisdiction within the City of Lodi.

The City of Lodi has informed WID of the proposed study and is currently coordinating with WID on the proposed scope of work. The City of Lodi will continue to work with WID as the study progresses and is prepared to enter into an interagency agreement as needed for implementation of the recommended alternative(s).

## 6. Recycled and Potable Water Supply Alternatives

The study will identify the infrastructure needed to expand recycled water usage through the City and the need for storage facilities to accommodate peak recycled water demands. Potential uses of recycled water within the City are expected to include:

- Agricultural irrigation;
- Urban (park, and streetscape) landscape irrigation;
- Residential irrigation;
- School landscape irrigation; and
- Dual plumbed business/commercial developments.

## 7. Opportunities for Stakeholder Participation

Outreach activities include meetings with the largest potential recycled water users identified as part of the market assessment, to gage their potential interest in using recycled water and discuss any preliminary concerns they may have relating to water quality and supply reliability.

Outreach to the general public will include the development of a recycled water brochure that describes the proposed recycled water project, benefits of recycled water and safety of its use. A public workshop will also be held to address any questions and/or concerns that the public may have.

## 8. Recycled Water Master Plan Schedule

The study is scheduled to begin October 16, 2006, but the start date is contingent upon the timing of the SWRCB review and approval of this grant application. Major milestones for the Study are as follows:

- Study Start Date: October 16, 2006
- Submittal of Draft Master Plan: April 11, 2007
- Submittal of Final Master Plan: June 28, 2007

A more detailed schedule and scope of work is included in Attachment 3.

## 9. Potential Problems and Proposed Actions to Reduce Impact

The City does not anticipate any potential problems that would delay progress in this study.

## 10. Entities Conducting the Study

The City of Lodi will be conducting the study and has asked RMC Water and Environment to prepare a scope of work to complete the study that is consistent with the requirements of Appendix B of the Water Recycling Funding Program Guidelines. The scope of work is broken down into 5 major tasks: Project Coordination, Recycled Water Feasibility Study, Alternatives Development and Evaluation, Recycled Water Outreach, and the Recycled Water Master Plan. Detailed information on each of these tasks is provided in Attachment 3. A summary description of the tasks is provided below:

Task 1 – Project Coordination

- This task involves the coordination and communication between the RMC team, the City and WID throughout the duration of the project, and the Quality Assurance/ Quality Control (QA/QC) activities for project deliverables.

Task 2 – Recycled Water Feasibility Study

- This task involves the investigation of recycled water potential in the City of Lodi and proposed areas of annexation by evaluating potential markets and confirming the quantity and quality of available recycled water supplies. As part of this evaluation, water use records and water quality needs of potential users will be evaluated.

Task 3 – Alternatives Development and Evaluation

- This task involves the development and evaluation of recycled water alternatives for delivering recycled water and non-potable water to potential recycled water customers within the City of Lodi. As part of this task, these alternatives will be compared to potential potable water supply alternatives for serving these demands. The results will be presented to the City and other interested stakeholders at a Workshop/Mid-course review meeting

Task 4 – Recycled Water Outreach

- This task involves conducting various outreach activities to potential recycled water users and the general public in order to educate them on the benefits of recycled water use.

Task 5 – Recycled Water Master Plan

- This task involves the development of a Recycled Water Master Plan for the City of Lodi. The Master Plan will include discussion of the study area characteristics, (e.g. existing water supplies, demands and plans for new facilities), recycled water market assessment, recommended project facilities, planning level cost estimates and financing plan, interagency agreements and recycled water assurances, and additional outreach and environmental compliance activities related to the recommended project.
- As required by Appendix B of the Water Recycling Guidelines, the RWMP will present the results of the evaluation of both recycled water and non-recycled water alternatives. This would include the results of an evaluation of an interim alternative that would involve use of recycled

water infrastructure to convey raw Woodbridge Irrigation District supplies for irrigation use within the City until a transmission line between the WSWPCF and the City is constructed; as well as the results of a longer-term alternatives that involve supplying recycled water to the City, it's annexation area, and future development located in the General Plan's sphere of influence.

## 11. Proposed Budget

The total cost of preparing the Recycled Water Master Plan for the City of Lodi is $160,000. These costs are broken down as follows:

**Table 1: Proposed Recycled Water Master Plan Budget**

| Task | RMC Costs | Subconsultant Costs | Total Costs |
|---|---|---|---|
| 1.0 Project Coordination | $14,240 | $0 | $14,240 |
| 2.0 Recycled Water Feasibility Study | $36,540 | $0 | $36,540 |
| 3.0 Alternative Analysis | $34,170 | $500 | $34,670 |
| 4.0 Recycled Water Outreach | $30,700 | $8,000 | $38,700 |
| 5.0 Recycled Water Master Plan | $34,350 | $1,500 | $35,850 |
| **Total** | **$150,000** | **$10,000** | **$160,000** |

The City will cover all costs incurred prior to dispersement of the grant funds from the Water Fund.

# References

California Department of Water Resources, "Bulletin 118 Update 2003," 2005.

RMC Water and Environment, City of Lodi Urban Water Management Plan, 2006.

# Attachment 2 – Authorized Representative Resolution

## AUTHORIZED REPRESENTATIVE RESOLUTION

**BE IT RESOLVED,** by the City Council that the City Manager hereby authorized and directed to sign and file, for and on behalf of the City of Lodi, a Financial Assistance Application for a loan/grant from the State Water Resources Control Board in the amount not to exceed $75,000 for the facilities planning study for the City of Lodi Recycled Water Master Plan, and

**BE IT RESOLVED**, that the City of Lodi hereby agrees and further does authorize the aforementioned representative or his/her designee to certify that the Agency has and will comply with all applicable state and federal statutory and regulatory requirements related to any federal state loan/grants received, and

**BE IT FURTHER RESOLVED**, that the City Manager or his/her designee of the City of Lodi is hereby authorized to negotiate and execute a loan/grant contract and any amendments or change orders thereto, and to certify loan/grant disbursement on behalf of the City of Lodi.

### CERTIFICATION

I do hereby certify that the foregoing is a full, true, and correct copy of a resolution duly and regularly adopted at a meeting of the City Council held on May 17, 2006.

(Seal)

Susan J. Blackston
City Clerk

RESOLUTION NO. 2006-91

A RESOLUTION OF THE LODI CITY COUNCIL AUTHORIZING THE CITY MANAGER TO EXECUTE GRANT APPLICATION TO THE STATE WATER RESOURCES CONTROL BOARD FOR THE FACILITIES PLANNING STUDY FOR THE CITY OF LODI RECYCLED WATER MASTER PLAN

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WHEREAS, as an incentive to municipalities to prepare Recycled Water Master Plans and to pursue the use of recycled water, the State Regional Water Quality Control Board (SRWQCB) is offering grants of up to $75,000 to help in the cost of preparing these plans; and

WHEREAS, while this plan is not required by the State, staff does believe that recycled water will be an important part of Lodi's future water supply and recommends that the City take advantage of this incentive program; and,

WHEREAS, the estimated cost of the plan is $150,000; and

WHEREAS, on February 1, 2006, the City Council approved a technical services task order agreement in the amount of $10,000 with RMC, Water Consultants, for preparation of the grant application, which is now complete, and staff hereby requests the necessary authorizations to submit the application.

NOW, THEREFORE, BE IT RESOLVED that the Lodi City Council does hereby authorize the City Manager to execute grant application to the State Water Resources Control Board for the Facilities Planning Study for the City of Lodi Recycled Water Master Plan in an amount not to exceed $75,000; to negotiate a grant contract and any amendments or change orders as required; and to certify that the City has and will comply with all applicable state and federal statutory and regulatory requirements related to any grants received.

Dated: May 17, 2006

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I hereby certify that Resolution No. 2006-91 was passed and adopted by the City Council of the City of Lodi in a regular meeting held May 17, 2006, by the following vote:

AYES: COUNCIL MEMBERS – Beckman, Hansen, Johnson, Mounce, and Mayor Hitchcock

NOES: COUNCIL MEMBERS – None

ABSENT: COUNCIL MEMBERS – None

ABSTAIN: COUNCIL MEMBERS – None

SUSAN J. BLACKSTON
City Clerk

# Attachment 3 – Scope of Work

RMC
Water and Environment

Los Angeles
Sacramento
San Francisco
San Jose
Walnut Creek

August 15, 2006

Mr. Charles Swimley, Jr.
Senior Civil Engineer
Public Works Department
City of Lodi
221 West Pine Street
P.O. Box 3006
Lodi, CA 95241-1910

**Subject: Task Order No. Two: Recycled Water Master Plan**

Dear Mr. Swimley:

At the City of Lodi's request, RMC Water and Environment (RMC) is pleased to present this proposal to prepare a Recycled Water Master Plan for the City.

**BACKGROUND**

The City of Lodi recognizes several benefits for developing a Recycled Water Master Plan (RWMP) to define the recycled water market potential and identify recommended projects to deliver recycled water for non-potable uses within the City and proposed areas of annexation:

- **Improves Water Supply Reliability.** Groundwater is currently the sole source of water supply used within the City. With the groundwater basin in a state of overdraft, the City of Lodi is in need of alternative supply sources to meet future water demands, which are projected to more than double between 2005 and 2040. Use of recycled water to serve non-potable demands within this area would preserve groundwater supplies for potable uses and provide additional supply reliability for the City.

- **Reduces Wastewater Discharges.** The City of Lodi, like other wastewater dischargers in the Central Valley, is facing increasingly stringent wastewater discharge regulations. Increased use of recycled water is a key strategy for complying with these future discharge regulations and helps to position the City for ultimately achieving zero discharge.

- **Provides Interim Solution for Use of Supplemental WID Supply.** The City of Lodi currently contracts with Woodbridge Irrigation District (WID) for an annual surface water supply of 6,000 AFY which is currently unused because the City does not yet have facilities in place to develop that supply. Early construction of portions of the recycled water distribution infrastructure could provide the City of Lodi with an interim usage of the raw water supplies from WID to serve non-potable irrigation demands. These demands would ultimately be served by recycled water once construction of all of the recycled water distribution facilities is completed.

The scope of work presented below is for development of a Recycled Water Master Plan which will evaluate the potential for recycled water use within the City limits and proposed westside annexation areas

140 Geary Street
9th Floor
San Francisco, CA 94108
ph: 415.321.3400
fax: 415.321.3401
www.rmcwater.com

**SCOPE OF WORK**

RMC has identified the following tasks to complete the scope of work for this project. The tasks associated with this scope of work comply with the requirements set forth in Appendix B of the Water Recycling Funding Program Guidelines.

**Task 1 Project Coordination**

This task involves the coordination and communications between the RMC team and the City throughout the duration of the project, and the Quality Assurance/ Quality Control (QA/QC) activities for project deliverables. An initial kickoff meeting will be held with the Project Team to confirm overall approach and schedule. RMC will also provide the City with monthly status updates for the project.

*Deliverables:*

1. Kick off Meeting
2. Monthly Status Reports

*Assumptions:*

- RMC will attend at total of four (4) coordination meetings (including the Kickoff meeting) with the City to discuss project status as needed.

**Task 2 Recycled Water Feasibility Study**

RMC will document the recycled water potential in the City of Lodi by evaluating potential markets and confirming the quantity and quality of available recycled water supplies. As part of this task, RMC will complete the following:

**Key Assumptions.** RMC will prepare a technical memorandum documenting the key assumptions that will be used in the development of the RWMP, including but not limited to: market assessment methodology, design criteria, and cost criteria. The TM will be revised based on comments from the City.

**Data Collection and Review.** RMC will collect and review any pertinent information for this project (e.g., previous planning reports; land use information; water use records to determine non-potable demands; recycled/raw water supply and quality data; available survey/geotechnical data; etc).

**Market Assessment.** RMC will build upon previous studies to conduct a detailed recycled water market assessment for the City. This assessment will involve the following tasks:

- *User Identification*. RMC will identify both urban, industrial and agricultural users within and surrounding the City of Lodi that could potentially use recycled water to meet non-potable demands. This will include identification of both existing and future recycled water users.
- *Demand Assessment*. Using water use records and evapotranspiration (E/T) data, RMC will determine the timing and quantity of non-potable demands for each of the potential recycled water users identified. This will include quantification of average annual demands, peak month demands, and peak hour demands.
- *Water Supply Assessment.* RMC will document the timing and quantity of recycled water and raw water WID supplies available to serve the non-potable demands within and around the City of Lodi, including peak month and annual supply availability.
- *Water Quality Assessment*. RMC will gather water quality data for the various water supply sources currently used in the study area, including (1) existing recycled water; (2) raw surface water (Mokelumne River) supplies; and (3) groundwater supplies. RMC will also evaluate water quality data projected for future recycled water supplies when the Lodi starts using the surface water supplies from WID.

  RMC will evaluate the quality of each of these supplies in relation to the water quality needs of the potential urban, industrial and agricultural recycled water users. This will include evaluation of various

water quality parameters of interest (e.g., total dissolved solids (TDS), chloride, sodium, ammonia, nitrate, nitrite, etc) to determine suitability as an irrigation supply, especially for sensitive crops types.

**Recycled Water Feasibility Workshop.** RMC will hold a workshop with the City and other interested stakeholders to present the preliminary results from the recycled water market assessment and review assumptions and outstanding items.

*Deliverables:*

1. Draft and Final Key Assumptions TM
2. Project Feasibility Workshop

*Assumptions:*

- Pertinent information will be readily accessible.
- The Recycled Water Feasibility workshop will be a half-day workshop, hosted by the City of Lodi

**Task 3 Alternatives Development and Evaluation**

RMC will develop and evaluate recycled water alternatives for delivering recycled water and non-potable water to potential recycled water customers within the City of Lodi. This task will involve the following:

- **Development of Conceptual Alternatives.** Based on the results of the market assessment, RMC will develop conceptual alternatives, including preliminary alignments (e.g. specific pipeline routes) for the recycled water and non-potable distribution systems, pumping/storage facility locations, and potential demands served by each alternative. Potential satellite treatment opportunities will be developed as appropriate. These conceptual alternatives will include an interim alternative to use raw water WID supplies to serve non-potable demands. RMC will prepare a technical memorandum describing the Conceptual Alternatives for the City's review and feedback. As part of this task, these alternatives will be compared to potential potable water supply alternatives that can be implemented to meet demands.

- **Alternative Refinement and Evaluation.** Based on preliminary feedback on the conceptual alternatives, RMC will refine the conceptual alternatives. A hydraulic model (e.g. H2O Map) will be used to determine facility requirements and sizing (e.g., pipeline, storage, pumping) for each alternative. In addition, planning level cost estimates (including capital costs, operation and maintenance costs, and unit costs) will be developed for each alternative.

- **Alternatives Evaluation Workshop/Mid-Course Review Meeting.** RMC will present the preliminary results of the alternatives evaluation at a workshop with the City and other interested stakeholders, including representatives from the State Water Resources Control Board.

*Deliverables:*

1. Conceptual Alternative TM
2. Alternatives Evaluation Workshop

*Assumptions:*

- No more than five recycled water alternatives, including a "No Project Alternative", will be developed.
- RMC will develop a hydraulic model using H2O Map (or similar) for determination of distribution facility sizing requirements.
- The Alternatives Evaluation Workshop will be a half-day workshop.

**Task 4 Recycled Water Outreach**

RMC will conduct various outreach activities to potential recycled water users and the general public in order to educate them on the benefits of recycled water use. This task will involve:

- **Initial Meetings with Potential Recycled Water Users/Opinion Leaders.** RMC will meet with the largest potential recycled water users and opinion leaders (e.g., major vineyards) to describe the purpose of the project, gage their potential interest in using recycled water and discuss any preliminary concerns they may have relating to water quality and supply reliability.
- **Follow-Up Meetings with Potential Recycled Water Users.** Following development of recycled water alternatives, RMC will hold follow-up meetings with the largest potential recycled water uses to present the alternatives and discuss any concerns they may have with implementation of the project. The results of these meetings will be incorporated into the recycled water master plan.
- **General Public Outreach.** RMC will develop a recycled water brochure that describes the proposed project, the benefits of recycled water and safety of its use. RMC will also help to facilitate a public workshop to address any questions and/or concerns that the public may have.

*Deliverables:*

1. Large User Meetings
2. Public Outreach Materials
3. Public Workshop

*Assumptions:*

- There will be a total of 5 initial meetings and 5 follow-up with the largest potential recycled water users
- The budget for development of the recycled water brochure will be limited to $10,000.

**Task 5 Recycled Water Master Plan**

This task involves development of Recycled Water Master Plan for the City of Lodi. The RWMP will include at least two phases – an interim phase that involves use of recycled water infrastructure to convey raw WID supplies; and a long-term phase that involves serving the annexation area, and future development located in the General Plan's sphere of influence.

- **Draft RWMP.** RMC will develop a Draft RWMP that documents the results from Tasks 2 -4 and presents the recommended recycled water project. Specifically, the Draft RWMP will include:
    - A summary of study area characteristics, including information on project setting (e.g., hydrologic features, groundwater basins, population and land use); water supply characteristics and facilities; wastewater characteristics and facilities.
    - Recycled water market assessment results (potential users and demands, water quality requirements, etc).
    - Specific alignments, locations and sizes for the recycled water and non-potable system alternatives and recommended project(s)
    - Preliminary cost estimates (capital, O&M, annual) for each alternative and the recommended project(s).
    - Potential funding/financing options to implement the recommended recycled water and non-potable projects.
    - A draft implementation plan that outlines strategies for interagency agreements with Woodbridge Irrigation District, additional recycled water outreach, permitting, and environmental compliance for the recommended project(s).
    - Preliminary recycled water market assurances for the recommended project(s) and a description of the anticipated schedule for future connections.
    - Potential policy option for developers as it relates to the installation of recycled water and/or non-potable distribution piping.

- **Draft RWMP Workshop.** RMC will facilitate a workshop with City staff and other interested stakeholders to review the recommendations of the Draft RWMP and solicit comments and feedback.

- **Final RWMP.** RMC will prepare a Final RWMP that incorporates all comments received on the Draft.

*Deliverables:*

1. Draft Master Plan
2. Final Master Plan

*Assumptions:*

- The Draft Master Plan will be provided electronically.
- The Master Plan Workshop will be a half-day workshop.
- Ten (10) copies of the Final Master Plan will be printed and distributed to the City.

**FEE ESTIMATE**

The fee estimate and for this scope of work is attached.

**SCHEDULE**

The tentative schedule for this scope of work is attached.

RMC greatly appreciates this opportunity to continue providing our consulting services to the City of Lodi. If you have any questions or require further information, please do not hesitate to call me at 415.321.3414.

Very truly yours,
**RMC Water and Environment**

Rachael M. Wark

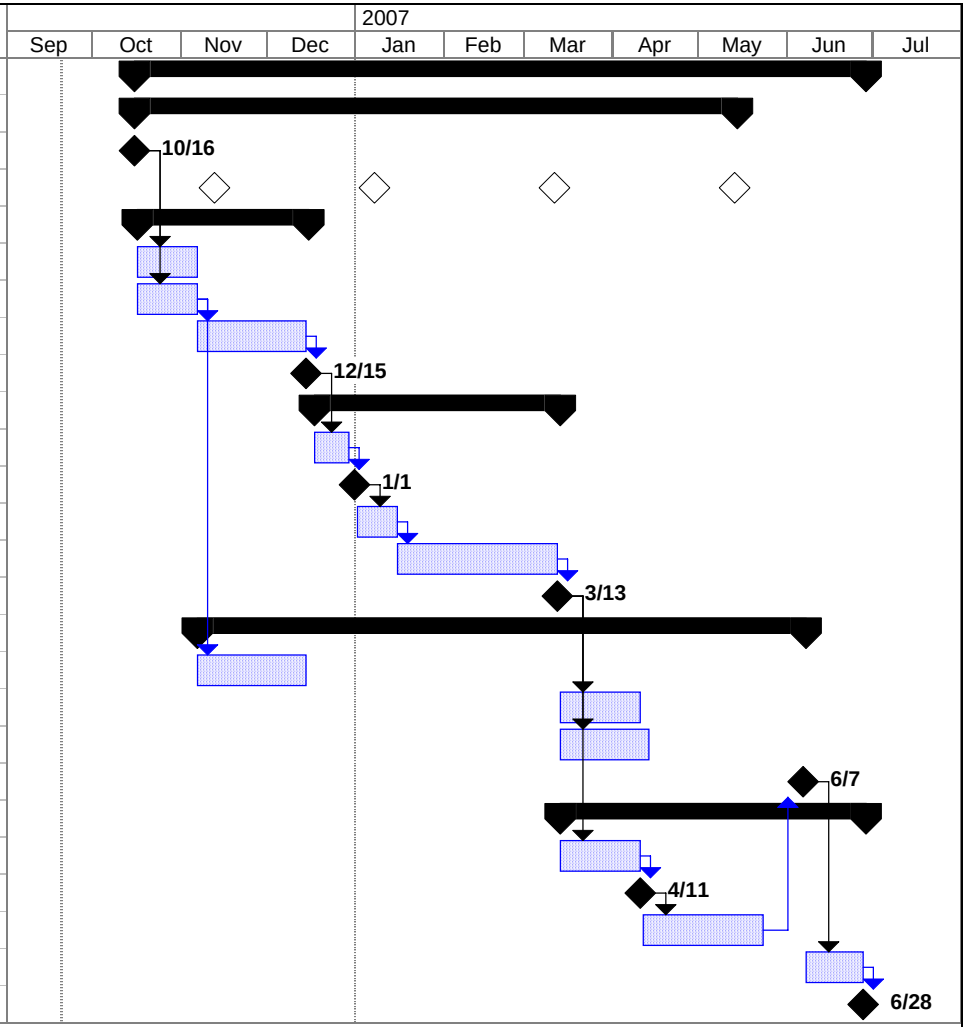
Rachael M. Wark, P.E.
Senior Project Manager

**City of Lodi**
**Recycled Water Master Plan**

**Fee Estimate**

| Task | Description | RMC Labor Hours | | | | | | RMC Labor ($) | Sub Costs | ODCs ($) | Mark-up (10%) | TOTAL COST ($) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | PIC | PM | PE 2 | PE 1 | Admin | *Total Hours* | | Lodi Graphic Design Firm | | | |
| | 2005 | $205/hr | $190/hr | $145/hr | $130/hr | $100/hr | | | | | | |
| **1.0** | **PROJECT COORDINATION** | **22** | **44** | **0** | **0** | **9** | ***75*** | **$13,800** | **$0** | **$400** | **$40** | **$14,240** |
| | Project Coordination | 14 | 40 | | | 9 | *63* | $11,400 | $0 | $400 | $40 | $11,840 |
| | QA/QC | 8 | 4 | | | | *12* | $2,400 | $0 | | $0 | $2,400 |
| **2.0** | **B RECYCLED WATER FEASIBILITY STUDY** | **14** | **50** | **120** | **48** | **0** | ***232*** | **$36,100** | **$0** | **$400** | **$40** | **$36,540** |
| | Key Assumptions TM | 2 | 6 | 20 | | | *28* | $4,500 | $0 | | $0 | $4,500 |
| | Data Collection | | 8 | 24 | | | *32* | $5,000 | $0 | $200 | $20 | $5,220 |
| | Market Assessment | 8 | 24 | 60 | 40 | | *132* | $20,100 | $0 | | $0 | $20,100 |
| | RW Feasibility Workshop | 4 | 12 | 16 | 8 | | *40* | $6,500 | $0 | $200 | $20 | $6,720 |
| **3.0** | **ALTERNATIVE ANALYSIS** | **14** | **44** | **84** | **80** | **0** | ***222*** | **$33,900** | **$500** | **$200** | **$70** | **$34,670** |
| | Development of Conceptual Alts - TM | 2 | 8 | 20 | 12 | | *42* | $6,400 | $500 | | $50 | $6,950 |
| | Alernative Refinement and Evaluation | 8 | 24 | 48 | 60 | | *140* | $21,000 | $0 | | $0 | $21,000 |
| | Alternative Evaluation Workshop | 4 | 12 | 16 | 8 | | *40* | $6,500 | $0 | $200 | $20 | $6,720 |
| **4.0** | **RECYCLED WATER OUTREACH** | **30** | **64** | **72** | **0** | **0** | ***166*** | **$28,800** | **$8,000** | **$1,000** | **$900** | **$38,700** |
| | Large Recycled Water User Meetings | 24 | 40 | 40 | | | *104* | $18,300 | $0 | | $0 | $18,300 |
| | Education Materials | 2 | 8 | 16 | | | *26* | $4,300 | $8,000 | $500 | $850 | $13,650 |
| | Public Workshop | 4 | 16 | 16 | | | *36* | $6,200 | $0 | $500 | $50 | $6,750 |
| **5.0** | **RECYCLED WATER MASTER PLAN** | **14** | **44** | **100** | **56** | **0** | ***214*** | **$33,100** | **$1,500** | **$1,000** | **$250** | **$35,850** |
| | Draft Master Plan | 8 | 24 | 60 | 32 | | *124* | $19,100 | $1,000 | | $100 | $20,200 |
| | Draft Master Plan Workshop | 4 | 8 | 16 | 8 | | *36* | $5,700 | $0 | | $0 | $5,700 |
| | Final Master Plan | 2 | 12 | 24 | 16 | | *54* | $8,300 | $500 | $1,000 | $150 | $9,950 |
| **SUBTOTAL** | | | | | | | | | | | | |
| *Subtotal Hours* | | *94* | *246* | *376* | *184* | *9* | *909* | | | | | |
| **Subtotal Cost** | | | | | | | | **$145,700** | **$10,000** | **$3,000** | **$1,300** | **$160,000** |

| ID | Task Name | Duration | Start | Finish |
|---|---|---|---|---|
| 1 | **Lodi Recycled Water Master Plan** | **184 days** | **Mon 10/16/06** | **Thu 6/28/07** |
| 2 | **Task 1 - Project Coordination** | **151 days** | **Mon 10/16/06** | **Mon 5/14/07** |
| 3 | Kickoff Mtg | 1 day | Mon 10/16/06 | Mon 10/16/06 |
| 4 | **Coordination Meetings** | **131 days** | **Mon 11/13/06** | **Mon 5/14/07** |
| 9 | **Task 2 - RW Feasibility Study** | **44 days** | **Tue 10/17/06** | **Fri 12/15/06** |
| 10 | Key Assumptions TM | 15 days | Tue 10/17/06 | Mon 11/6/06 |
| 11 | Data Collection | 15 days | Tue 10/17/06 | Mon 11/6/06 |
| 12 | Market Assessment | 28 days | Tue 11/7/06 | Thu 12/14/06 |
| 13 | RW Feasibility Workshop | 1 day | Fri 12/15/06 | Fri 12/15/06 |
| 14 | **Task 3 - Alternative Analysis** | **62 days** | **Mon 12/18/06** | **Tue 3/13/07** |
| 15 | Develop Conceptual Alts | 2 wks | Mon 12/18/06 | Fri 12/29/06 |
| 16 | Submit TM | 1 day | Mon 1/1/07 | Mon 1/1/07 |
| 17 | City Review | 2 wks | Tue 1/2/07 | Mon 1/15/07 |
| 18 | Alt Evaluation | 40 days | Tue 1/16/07 | Mon 3/12/07 |
| 19 | Alts Evaluation Workshop | 1 day | Tue 3/13/07 | Tue 3/13/07 |
| 20 | **Task 4 - Recycled Water Outreach** | **153 days** | **Tue 11/7/06** | **Thu 6/7/07** |
| 21 | Initial Meetings with Targeted Us | 28 days | Tue 11/7/06 | Thu 12/14/06 |
| 22 | Follow-Up Meetings with Targete | 20 days | Wed 3/14/07 | Tue 4/10/07 |
| 23 | Outreach Materials | 23 days | Wed 3/14/07 | Fri 4/13/07 |
| 24 | Public Meeting | 1 day | Thu 6/7/07 | Thu 6/7/07 |
| 25 | **Task 5 - RWMP** | **77 days** | **Wed 3/14/07** | **Thu 6/28/07** |
| 26 | Prepare Draft | 20 days | Wed 3/14/07 | Tue 4/10/07 |
| 27 | Submit Draft | 1 day | Wed 4/11/07 | Wed 4/11/07 |
| 28 | City/SWRCB Review | 30 days | Thu 4/12/07 | Wed 5/23/07 |
| 29 | Prepare Final | 14 days | Fri 6/8/07 | Wed 6/27/07 |
| 30 | Submit Final | 1 day | Thu 6/28/07 | Thu 6/28/07 |




Project: Lodi RWMP
Date: September 2006

Task
Split
Progress
Milestone
Summary
Project Summary
External Tasks
External Milestone
Deadline

# Appendix J Recycled Water Alternatives Evaluation Backup Information

**Project:** Lodi RWMP

**Aspect:** Cost Estimate Comparison

Estimate Type: Facilities Plan

Date: August 3, 2007
Project Number: 140-003

Prepared by: ob
Checked by:
Check Date:

| Elements | Alternative A Storage Option 1 | Alternative A Storage Option 2 | Alternative D |
|---|---|---|---|
| Pipeline | $ 16,865,000 | $ 16,865,000 | $ 6,017,000 |
| Pump Station | $ 820,000 | $ 895,000 | $ 580,000 |
| Storage Facility | $ 37,353,610 | $ 29,594,348 | $ 19,834,418 |
| | | | |
| **Raw Construction Cost** | $ 57,026,000 | $ 49,341,000 | $ 27,033,000 |
| | | | |
| Contractor OH&P (10%) | $ 11,405,000 | $ 9,868,000 | $ 5,407,000 |
| Change Order Allowance (5%) | $ 2,851,000 | $ 2,467,000 | $ 1,352,000 |
| **Subtotal Construction Cost** | $ 71,282,000 | $ 61,676,000 | $ 33,792,000 |
| | | | |
| Land and Right of Way | $ 15,046,000 | $ 11,906,000 | $ 7,966,000 |
| Planning Phase Unknown Allowance (30%) | $ 21,385,000 | $ 18,503,000 | $ 10,138,000 |
| **Construction Cost** | $ 107,713,000 | $ 92,085,000 | $ 51,896,000 |
| | | | |
| Environmental Documentation (2%) | $ 2,154,000 | $ 1,842,000 | $ 1,038,000 |
| Engineering, Administration, and Legal (10%) | $ 10,771,000 | $ 9,209,000 | $ 5,190,000 |
| Construction Management (15%) | $ 16,157,000 | $ 13,813,000 | $ 7,784,000 |
| | | | |
| **Capital Cost** | **$ 136,795,000** | **$ 116,949,000** | **$ 65,908,000** |
| | | | |
| O&M | $ 1,433,000 | $ 1,248,000 | $ 712,000 |
| Annualized Capital Costs | $ 10,701,000 | $ 9,149,000 | $ 5,156,000 |
| Annualized Costs | $ 12,134,000 | $ 10,397,000 | $ 5,868,000 |
| **Cost per AF** | **$ 2,429** | **$ 2,081** | **$ 1,807** |

# Alternative A
# Cost Estimate

## Capital Facility

| White Slough Pump Station | | Storage Option 1 | Storage Option 2 |
|---|---|---|---|
| Pump Station Facilities | | $820,000 | $510,000 |
| Seasonal Storage Ponds | | $37,353,610 | $29,594,348 |
| | **Total** | **$38,173,610** | **$30,104,348** |
| **WID Water Canal Pump Station** | | | |
| Pump Station Facilities | | | $385,000 |
| | **Total** | **$0** | **$385,000** |
| **RW Main Pipeline (Open Trench)** | **$/lf** | | |
| 6 in (PVC) | $47 | $247,559 | $247,559 |
| 8 in PVC | $73 | $596,848 | $596,848 |
| 12 in diameter pipe | $124 | $3,274,773 | $3,274,773 |
| 16 in diameter pipe | $176 | $456,098 | $456,098 |
| 24 in diameter pipe | $273 | $12,220,042 | $12,220,042 |
| 30 in diameter pipe | $337 | $69,956 | $69,956 |
| | **Total** | **$16,865,000** | **$16,865,000** |
| **RW Main Pipeline (Bore & Jack)** | **$/lf** | | |
| UPRR tracks crossing (200 ft) | $1,500 | $300,000 | $300,000 |
| | **Total** | **$300,000** | **$300,000** |
| **Appurtenances** | | | |
| Appurtenances | 10% of pipeline | $1,687,000 | $1,687,000 |
| | **Total** | **$1,687,000** | **$1,687,000** |
| | **Raw Construction Cost** | **$57,026,000** | **$49,341,000** |
| | **Contractor OH&P (10%)** | $11,405,000 | $9,868,000 |
| | **Change Order Allowance (5%)** | $2,851,000 | $2,467,000 |
| | **Subtotal Construction Cost** | **$71,282,000** | **$61,676,000** |
| | **Land & Right of Way** | $15,046,000 | $11,906,000 |
| | **Construction Phase Unknown Allowance (30%)** | $21,385,000 | $18,503,000 |
| | **Subtotal Construction Cost** | **$107,713,000** | **$92,085,000** |
| | **Environmental Documentation (2%)** | $2,154,000 | $1,842,000 |
| | **Engineering, Administration, and Legal (10%)** | $10,771,000 | $9,209,000 |
| | **Construction Management (15%)** | $16,157,000 | $13,813,000 |
| | **Total Project Cost** | **$136,795,000** | **$116,949,000** |

| O&M | | |
|---|---|---|
| Annual Operation | $65,374 | $79,178 |
| Annual Maintenance | $1,368,000 | $1,169,000 |
| **Total** | **$1,433,000** | **$1,248,000** |
| **Present Worth O&M** | | |
| Present Worth | **$18,323,000** | **$15,956,000** |

| | | |
|---|---|---|
| **Total Present Worth Cost** | **$155,118,000** | **$132,905,000** |
| **Annualized Costs** | **$12,134,000** | **$10,397,000** |
| **Annual Unit Cost (Per AF Disposal)** | **$2,429** | **$2,081** |

# Alternative D
# Cost Estimate

## Capital Facility

| White Slough Pump Station | | |
|---|---|---|
| Pump Station Facilities | | $580,000 |
| Seasonal Storage Ponds | | $19,834,418 |
| | **Total** | **$20,414,418** |

| RW Main Pipeline (Open Trench) | $/lf | |
|---|---|---|
| 12 in diameter pipe | $124 | $1,525,430 |
| 16 in diameter pipe | $176 | $2,202,856 |
| 24 in diameter pipe | $273 | $2,226,590 |
| 30 in diameter pipe | $337 | $62,273 |
| | **Total** | **$6,017,000** |

| RW Main Pipeline (Bore & Jack) | $/lf | |
|---|---|---|
| UPRR tracks crossing (200 ft) | $0 | $0 |
| | **Total** | **$0** |

| Appurtenances | | |
|---|---|---|
| Appurtenances | 10% of pipeline | $602,000 |
| | **Total** | **$602,000** |
| | **Raw Construction Cost** | **$27,033,000** |
| | **Contractor OH&P (10%)** | $5,407,000 |
| | **Change Order Allowance (5%)** | $1,352,000 |
| | **Subtotal Construction Cost** | **$33,792,000** |
| | **Land & Right of Way** | $7,966,000 |
| | **Construction Phase Unknown Allowance (30%)** | $10,138,000 |
| | **Subtotal Construction Cost** | **$51,896,000** |
| | **Environmental Documentation (2%)** | $1,038,000 |
| | **Engineering, Administration, and Legal (10%)** | $5,190,000 |
| | **Construction Management (15%)** | $7,784,000 |
| | **Total Project Cost** | **$65,908,000** |

| O&M | |
|---|---|
| Annual Operation | $53,432 |
| Annual Maintenance | $659,000 |
| **Total** | **$712,000** |

| Present Worth O&M | |
|---|---|
| Present Worth | **$9,557,000** |

| | |
|---|---|
| **Total Present Worth Cost** | **$75,465,000** |
| **Annualized Costs** | **$5,868,000** |
| **Annual Unit Cost (Per AF Disposal)** | **$1,807** |

| Capital Facility | | Alternative A Looped | | Alternative D Looped |
|---|---|---|---|---|
| | | Storage Option 1 | Storage Option 2 | |
| **White Slough Pump Station** | | | | |
| Pump Station Facilities | | $820,000 | $510,000 | $580,000 |
| Seasonal Storage Ponds | | $37,353,610 | $29,594,348 | $19,834,418 |
| | **Total** | **$38,173,610** | **$30,104,348** | **$20,414,418** |
| **WID Water Canal Pump Station** | | | | |
| Pump Station Facilities | | | $385,000 | |
| | **Total** | **$0** | **$385,000** | **$0** |
| **RW Main Pipeline (Open Trench)** | **$/lf** | | | |
| 6 in (PVC) | $47 | $247,559 | $247,559 | |
| 8 in PVC | $73 | $596,848 | $596,848 | |
| 12 in diameter pipe | $124 | $3,274,773 | $3,274,773 | $1,525,430 |
| 16 in diameter pipe | $176 | $456,098 | $456,098 | $2,202,856 |
| 24 in diameter pipe | $273 | $12,220,042 | $12,220,042 | $2,226,590 |
| 30 in diameter pipe | $337 | $69,956 | $69,956 | $62,273 |
| | **Total** | **$16,865,000** | **$16,865,000** | **$6,017,000** |
| **RW Main Pipeline (Bore & Jack)** | **$/lf** | | | |
| UPRR tracks crossing (200 ft) | $1,500 | $300,000 | $300,000 | $0 |
| | **Total** | **$300,000** | **$300,000** | **$0** |
| **Appurtenances** | | | | |
| Appurtenances | 10% of pipeline | $1,687,000 | $1,687,000 | $602,000 |
| | **Total** | **$1,687,000** | **$1,687,000** | **$602,000** |
| | **Raw Construction Cost** | **$57,026,000** | **$49,341,000** | **$27,033,000** |
| | **Contractor OH&P (10%)** | $11,405,000 | $9,868,000 | $5,407,000 |
| | **Change Order Allowance (5%)** | $2,851,000 | $2,467,000 | $1,352,000 |
| | **Subtotal Construction Cost** | **$71,282,000** | **$61,676,000** | **$33,792,000** |
| | **Land & Right of Way** | $15,046,000 | $11,906,000 | $7,966,000 |
| | **Construction Phase Unknown Allowance (30%)** | $21,385,000 | $18,503,000 | $10,138,000 |
| | **Subtotal Construction Cost** | **$107,713,000** | **$92,085,000** | **$51,896,000** |
| | **Environmental Documentation (2%)** | $2,154,000 | $1,842,000 | $1,038,000 |
| | **Engineering, Administration, and Legal (10%)** | $10,771,000 | $9,209,000 | $5,190,000 |
| | **Construction Management (15%)** | $16,157,000 | $13,813,000 | $7,784,000 |
| | **Total Project Cost** | **$136,795,000** | **$116,949,000** | **$65,908,000** |
| **O&M** | | | | |
| Annual Operation | | $65,374 | $79,178 | $53,432 |
| Annual Maintenance | | $1,368,000 | $1,169,000 | $659,000 |
| | **Total** | **$1,433,000** | **$1,248,000** | **$712,000** |
| **Present Worth O&M** | | | | |
| Present Worth | | **$18,323,000** | **$15,956,000** | **$9,107,000** |
| **Total Present Worth Cost** | | **$155,118,000** | **$132,905,000** | **$75,015,000** |
| **Annualized Costs** | | **$12,134,000** | **$10,397,000** | **$5,868,000** |
| **Annual Unit Cost (Per AF Disposal)** | | **$2,429** | **$2,081** | **$1,807** |

# Alternative D

## Storage Option 1: Seasonal Storage for On- and Off-site RW Requirements

| Month | No. of Days | Lodi Effluent Flow 2005 (mgd) | Lodi Effluent Flow Build Out (mgd) | Available RW (MG) | On-Site Demand (MG) | On-Site Demand (mgd) | Off-Site Demand (mgd) | Total Demand (mgd) | Total Demand (MG) | Storable RW (MG) | Cumulative Stored Volume (MG) | Stored or Withdrawn (MG) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| J | 31 | 6.2 | 8.5 | 263.5 | - | - | - | - | - | 263.5 | - | 263.5 |
| F | 28 | 6.2 | 8.5 | 238.0 | - | - | - | - | - | 238.0 | 91.2 | 238.0 |
| M | 31 | 6.2 | 8.5 | 263.5 | - | - | - | - | - | 263.5 | 354.7 | 263.5 |
| A | 30 | 6.2 | 8.5 | 255.0 | 81.2 | 2.7 | 0.3 | 3.0 | 90.6 | 164.4 | 519.1 | 164.1 |
| M | 31 | 6.2 | 8.5 | 263.5 | 130.7 | 4.2 | 4.6 | 8.8 | 273.6 | (10.1) | 509.0 | (14.7) |
| J | 30 | 6.2 | 8.5 | 255.0 | 179.6 | 6.0 | 9.3 | 15.3 | 459.0 | (204.0) | 305.1 | (213.3) |
| J | 31 | 6.2 | 8.5 | 263.5 | 188.1 | 6.1 | 9.9 | 16.0 | 495.8 | (232.3) | 72.8 | (242.2) |
| A | 31 | 6.2 | 8.5 | 263.5 | 135.7 | 4.4 | 6.5 | 10.8 | 336.3 | (72.8) | (0.0) | (79.3) |
| S | 30 | 6.2 | 8.5 | 255.0 | 135.0 | 4.5 | 3.0 | 7.5 | 223.8 | 31.2 | - | 28.3 |
| O | 31 | 6.2 | 8.5 | 263.5 | 41.7 | 1.3 | 1.0 | 2.3 | 72.0 | 191.5 | - | 190.6 |
| N | 30 | 6.2 | 8.5 | 255.0 | - | - | - | - | - | 255.0 | - | 255.0 |
| D | 31 | 6.2 | 8.5 | 263.5 | - | - | - | - | - | 263.5 | - | 263.5 |
| **TOTAL** | | | | **3,103** | **892** | | | | **1,951** | **1,152** | | |

Maxium Storage Volume

| | |
|---|---|
| 519 | MG |
| 1,593 | af |

**LODI RW DEMAND**

1,059 MG

| | No. of Days | % Annual Demand | Monthly Demand Volume (MG) | Monthly Demand Flow (mgd) |
|---|---|---|---|---|
| January | 31 | 0.0% | - | - |
| February | 28 | 0.0% | - | - |
| March | 31 | 0.0% | - | - |
| April | 30 | 0.9% | 9.4 | 0.31 |
| May | 31 | 13.5% | 142.9 | 4.61 |
| June | 30 | 26.4% | 279.4 | 9.31 |
| July | 31 | 29.1% | 307.7 | 9.93 |
| August | 31 | 18.9% | 200.6 | 6.47 |
| September | 30 | 8.4% | 88.8 | 2.96 |
| October | 31 | 2.9% | 30.3 | 0.98 |
| November | 30 | 0.0% | - | - |
| December | 31 | 0.0% | - | - |
| **TOTAL** | | **100.0%** | **1,059.00** | |

1 acre = 43 560 square foot
1 US gallon = 0.133680556 cubic foot
1 cubic foot = 7.480 519 481 gallon

| | | |
|---|---|---|
| Prelim. Storage requirements | 519,119,230 | gallons |
| | 69,396,152 | cubic feet |
| | 10 | depth of pond, feet |
| | 6,939,615 | surface area of pond, square feet |
| | 159.31 | surface area of pond, acres |

# Alternative A

## Storage Option 2: Seasonal Storage for On-Site RW Requirements

| Month | No. of Days | Lodi Effluent Flow 2005 (mgd) | Lodi Effluent Flow Build Out (mgd) | Available RW (MG) | On-Site Demand (MG) | On-Site Demand (mgd) | Storable RW (Pre-Offsite Use) (MG) | Cumulative Stored Volume (MG) | Remaining Available RW (mgd) | Off-Site Demand (mgd) | Req'd WID/GW Input (mgd) | Total WID/GW Demand (MG) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| J | 31 | 6.2 | 8.5 | 263.5 | - | - | 263.5 | 153.5 | - | - | - | - |
| F | 28 | 6.2 | 8.5 | 238.0 | - | - | 238.0 | 391.5 | - | - | - | - |
| M | 31 | 6.2 | 8.5 | 263.5 | - | - | 263.5 | 642.5 | 8.5 | 0.4 | - | - |
| A | 30 | 6.2 | 8.5 | 255.0 | 81.2 | 2.7 | 173.8 | 775.9 | 8.5 | 1.3 | - | - |
| M | 31 | 6.2 | 8.5 | 263.5 | 130.7 | 4.2 | 132.8 | 680.1 | 8.5 | 7.4 | - | - |
| J | 30 | 6.2 | 8.5 | 255.0 | 179.6 | 6.0 | 75.4 | 500.5 | 8.5 | 13.2 | 4.7 | 140.2 |
| J | 31 | 6.2 | 8.5 | 263.5 | 188.1 | 6.1 | 75.4 | 312.4 | 8.5 | 14.0 | 5.5 | 170.7 |
| A | 31 | 6.2 | 8.5 | 263.5 | 135.7 | 4.4 | 127.8 | 176.7 | 8.5 | 9.7 | 1.2 | 36.4 |
| S | 30 | 6.2 | 8.5 | 255.0 | 135.0 | 4.5 | 120.0 | 41.7 | 8.5 | 5.1 | - | - |
| O | 31 | 6.2 | 8.5 | 263.5 | 41.7 | 1.3 | 221.8 | - | 8.5 | 2.0 | - | - |
| N | 30 | 6.2 | 8.5 | 255.0 | - | - | 255.0 | | 8.5 | 0.0 | - | - |
| D | 31 | 6.2 | 8.5 | 263.5 | - | - | 263.5 | | - | - | - | - |
| **TOTAL** | | | | **3,103** | **892** | | | | | | | **347** |

Maxium Storage Volume

776 MG

2,381 af

Total WID/GW Demand

1,066 afy

**LODI RW DEMAND**

1,628 MG

| | No. of Days | % Annual Demand | Monthly Demand Volume (MG) | Monthly Demand Flow (mgd) |
|---|---|---|---|---|
| January | 31 | 0.0% | - | - |
| February | 28 | 0.0% | - | - |
| March | 31 | 0.8% | 12.5 | 0.40 |
| April | 30 | 2.5% | 40.4 | 1.35 |
| May | 31 | 14.0% | 228.6 | 7.37 |
| June | 30 | 24.3% | 395.2 | 13.17 |
| July | 31 | 26.7% | 434.2 | 14.01 |
| August | 31 | 18.4% | 299.9 | 9.68 |
| September | 30 | 9.5% | 154.0 | 5.13 |
| October | 31 | 3.8% | 62.1 | 2.00 |
| November | 30 | 0.1% | 1.1 | 0.04 |
| December | 31 | 0.0% | - | - |
| **TOTAL** | | **100.0%** | **1,628.00** | |

1 acre = 43 560 square foot
1 US gallon = 0.133680556 cubic foot
1 cubic foot = 7.480 519 481 gallon

Prelim. Storage requirements:

| | |
|---|---|
| 775,894,674 | gallons |
| 103,722,038 | cubic feet |
| 10 | depth of pond, feet |
| 10,372,204 | surface area of pond, square feet |
| 238.11 | surface area of pond, acres |

# Alternative A

## Storage Option 1: Seasonal Storage for On- and Off-site RW Requirements

| Month | No. of Days | Lodi Effluent Flow 2005 (mgd) | Lodi Effluent Flow Build Out (mgd) | Available RW (MG) | On-Site Demand (MG) | On-Site Demand (mgd) | Off-Site Demand (mgd) | Total Demand (mgd) | Total Demand (MG) | Storable RW (MG) | Cumulative Stored Volume (MG) | Stored or Withdrawn (MG) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| J | 31 | 6.2 | 8.5 | 263.5 | - | - | - | - | - | 263.5 | 358.2 | 263.5 |
| F | 28 | 6.2 | 8.5 | 238.0 | - | - | - | - | - | 238.0 | 596.2 | 238.0 |
| M | 31 | 6.2 | 8.5 | 263.5 | - | - | 0.4 | 0.4 | 12.5 | 251.0 | 847.2 | 250.6 |
| A | 30 | 6.2 | 8.5 | 255.0 | 81.2 | 2.7 | 1.3 | 4.1 | 121.6 | 133.4 | 980.6 | 132.0 |
| M | 31 | 6.2 | 8.5 | 263.5 | 130.7 | 4.2 | 7.4 | 11.6 | 359.3 | (95.8) | 884.8 | (103.2) |
| J | 30 | 6.2 | 8.5 | 255.0 | 179.6 | 6.0 | 13.2 | 19.2 | 574.8 | (319.8) | 565.0 | (333.0) |
| J | 31 | 6.2 | 8.5 | 263.5 | 188.1 | 6.1 | 14.0 | 20.1 | 622.3 | (358.8) | 206.2 | (372.8) |
| A | 31 | 6.2 | 8.5 | 263.5 | 135.7 | 4.4 | 9.7 | 14.1 | 435.6 | (172.1) | 34.0 | (181.8) |
| S | 30 | 6.2 | 8.5 | 255.0 | 135.0 | 4.5 | 5.1 | 9.6 | 289.0 | (34.0) | (0.0) | (39.2) |
| O | 31 | 6.2 | 8.5 | 263.5 | 41.7 | 1.3 | 2.0 | 3.3 | 103.8 | 159.7 | - | 157.7 |
| N | 30 | 6.2 | 8.5 | 255.0 | - | - | 0.0 | 0.0 | 1.1 | 253.9 | - | 253.9 |
| D | 31 | 6.2 | 8.5 | 263.5 | - | - | - | - | - | 263.5 | 94.7 | 263.5 |
| **TOTAL** | | | | **3,103** | **892** | | | | **2,520** | **583** | | |

Maxium Storage Volume

| | |
|---|---|
| 981 | MG |
| 3,009 | af |

**LODI RW DEMAND**

1,628 MG

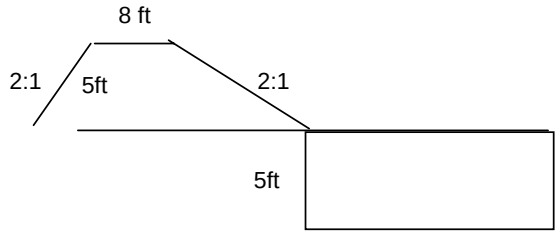
| | No. of Days | % Annual Demand | Monthly Demand Volume (MG) | Monthly Demand Flow (mgd) |
|---|---|---|---|---|
| January | 31 | 0.0% | - | - |
| February | 28 | 0.0% | - | - |
| March | 31 | 0.8% | 12.5 | 0.40 |
| April | 30 | 2.5% | 40.4 | 1.35 |
| May | 31 | 14.0% | 228.6 | 7.37 |
| June | 30 | 24.3% | 395.2 | 13.17 |
| July | 31 | 26.7% | 434.2 | 14.01 |
| August | 31 | 18.4% | 299.9 | 9.68 |
| September | 30 | 9.5% | 154.0 | 5.13 |
| October | 31 | 3.8% | 62.1 | 2.00 |
| November | 30 | 0.1% | 1.1 | 0.04 |
| December | 31 | 0.0% | - | - |
| **TOTAL** | | **100.0%** | **1,628.00** | |

1 acre = 43 560 square foot
1 US gallon = 0.133680556 cubic foot
1 cubic foot = 7.480 519 481 gallon

| | | |
|---|---|---|
| Prelim. Storage requirements: | 980,577,425 | gallons |
| | 131,084,143 | cubic feet |
| | 10 | depth of pond, feet |
| | 13,108,414 | surface area of pond, square feet |
| | 300.93 | surface area of pond, acres |

## Alt A - Storage Option 1

| | | | | | |
|---|---|---|---|---|---|
| Reservoir Volume | 3,009 | afy | | | |
| **Depth** | 10 | ft | | | |
| area | 300.9 | acre | | | |
| | 13,108,415 | sf | | | |
| perimeter | 14,482 | ft | | | |
| perimeter area | 144,822 | sf | | | |




| | | | | | | |
|---|---|---|---|---|---|---|
| **Excavation** | | 65,542,073 | cf | unit cost | | |
| | cost | $7,282,453 | $ | 3 | $/CY | |
| **Berm** | x-section | 90 | sf | unit cost | | |
| | volume | 1,303,400 | cf | 13 | $/CY | |
| | Cost | $627,563 | $ | | | |
| **Liner** | cost | $19,879,855 | $ | unit cost 1.5 | $/sf | |
| **Land Cost** | | 301 | acre | unit cost | | |
| | cost | $15,046,390 | | 50,000 | $/acre | |
| **Offhaul** | | 64,238,674 | cf | unit | | |
| | cost | $9,516,841 | | 4 | $/CY | |
| **Total Costs** | | **$52,400,000** | | | | |

## Alt A - Storage Option 2

| | | | | | |
|---|---|---|---|---|---|
| Reservoir Volume | 2,381 | afy | | | |
| **Depth** | 10 | ft | | | |
| area | 238.1 | acre | | | |
| | 10,372,204 | sf | | | |
| perimeter | 12,882 | ft | | | |
| perimeter area | 128,824 | sf | | | |

| | | | | | |
|---|---|---|---|---|---|
| **Excavation** | | 51,861,020 | cf | | |
| | cost | $5,762,336 | $ | | |
| **Berm** | x-section | 90 | sf | | |
| | volume | 1,159,413 | cf | | |
| | Cost | $558,236 | $ | | |
| **Liner** | cost | $15,751,541 | $ | | |
| **Land Cost** | | 238 | acre | | |
| | cost | $11,905,652 | | | |
| Offhaul | | 50,701,607 | cf | | |
| | cost | $7,511,349 | | | |
| **Total Costs** | | **$41,500,000** | | | |

## Alt D - Storage Option 1

| | | | |
|---|---|---|---|
| Reservoir Volume | 1,593 | afy | |
| **Depth** | 10 | ft | |
| area | 159.3 | acre | |
| | 6,939,615 | sf | |
| perimeter | 10,537 | ft | |
| perimeter area | 105,373 | sf | |

| | | | |
|---|---|---|---|
| **Excavation** | | 34,698,077 | cf |
| | cost | $3,855,342 | $ |
| **Berm** | x-section | 90 | sf |
| | volume | 948,353 | cf |
| | Cost | $456,615 | $ |
| **Liner** | cost | $10,567,482 | $ |
| **Land Cost** | | 159 | acre |
| | cost | $7,965,582 | |
| Offhaul | | 33,749,723 | cf |
| | cost | $4,999,959 | |
| **Total Costs** | | **$27,800,000** | |

# Appendix K City of Lodi and WID Water Service Rates

| Post-it® Fax Note 7671 | Date 8/13/07 | # of pages ▶ 1 |
|---|---|---|
| To ANDY SMITH | From LYMAN CHANG | |
| Co./Dept. RMC | Co. CITY OF LODI | |
| Phone # | Phone # | |
| Fax # 916 273 1501 | Fax # | |

City of Lodi

Public Works Department

## Water

**Add applicable Development Impact Mitigation Fees - See Page 5**

Reference: LMC §13.04.050

(Installations requiring jacking or special construction per T&M estimate)

* If the same address is simultaneously installing both new water and wastewater services, charge 80% of these listed costs.

**Service Installation**

| | |
|---|---|
| Service Only w/o meter - 1" | $ 2,400.00 * |
| 1½" | $ 3,200.00 * |
| 2" | $ 3,400.00 * |
| 3" & over | per T&M estimate |
| Upgrade of existing service w/line replacement | |
| In street or alley w/o meter | 80% of above |
| In easement w/o meter | 66⅔% of above |
| Upgrade of existing service w/o line replacement | |
| In street or alley w/o meter | 66⅔% of above |
| In easement w/o meter | 50% of above |
| Complete Service with meter - 1" | $ 2,635.00 |
| 1½" | $ 3,645.00 |
| 2" | $ 4,000.00 |
| 3" & over | per T&M estimate |
| Meter install only - ¾" | $ 345.00 ** |
| 1" | $ 375.00 ** |
| 1½" | $ 585.00 ** |
| 2" | $ 740.00 ** |
| Turbo, Compound, or 3" & over | per estimate |
| "TouchRead" or ERY install only | $ 230.00 |
| Disconnect/Abandon service: | |
| 2" & under | $ 900.00 |
| over 2" | per T&M estimate |

For service installed with downsized meter, charge will be adjusted.
(Example: 2" service w/1½" meter: $3,400 + $585 - $140 = $3,845)

Credit may be allowed for meter removed if less than 5 years old.

** Cost includes $140 to set meter plus Admin.

| Typical Circumstances and Costs in Street or Alley | |
|---|---|
| New 1" service with ¾" meter | $ 2,605 |
| Upgrade 1" service,line & box with ¾" meter | $ 2,125 |
| Upgrade 1" box with ¾" meter | $ 1,803 |
| Install ¾" meter in existing suitable service | $ 345 |

| | | |
|---|---|---|
| Bacterial Sampling Fee | $ 45.00 | per sample |

**Service Charges** (2) (Water rates below effective 7/1/07 - 6/30/08) Reference: Resolution No. 2007-113

| | Total | Base | I S R (3) | PCE/TCE | |
|---|---|---|---|---|---|
| Residential Flat Rate (per month): | | | | | |
| Single Family Unit (one bedroom) | $ 26.95 | $ 14.42 | $ 5.24 | $ 7.29 | |
| (two bedrooms) | $ 32.37 | $ 17.31 | $ 6.30 | $ 8.76 | |
| (three bedrooms) | $ 38.79 | $ 20.75 | $ 7.54 | $ 10.50 | |
| (four bedrooms) | $ 46.61 | $ 24.93 | $ 9.07 | $ 12.61 | |
| (five bedrooms) | $ 55.91 | $ 29.90 | $ 10.88 | $ 15.13 | |
| (six bedrooms) | $ 67.09 | $ 35.88 | $ 13.05 | $ 18.16 | |
| (seven bedrooms) | $ 80.49 | $ 43.05 | $ 15.66 | $ 21.78 | |
| Multiple Family Unit (one bedroom) | $ 23.13 | $ 12.37 | $ 4.50 | $ 6.26 | |
| (two bedrooms) | $ 27.74 | $ 14.83 | $ 5.40 | $ 7.51 | |
| (three bedrooms) | $ 33.29 | $ 17.80 | $ 6.48 | $ 9.01 | + 20% for ea. add'l. bedroom |

Commercial/Industrial Flat Rate — Existing accounts only. New accounts are metered.

| Metered Rate | Total | Base | I S R (3) | PCE/TCE | |
|---|---|---|---|---|---|
| Commodity Charge (1) | $ 0.760 | $ 0.517 | $ 0.243 | - | per 100 cu. ft. (approx. $1.016 per 1,000 gal.) |
| (1) plus monthly meter charge: | $ 24.69 | $ 15.13 | - | $ 9.56 | 5/8" meter |
| | $ 27.13 | $ 16.63 | - | $ 10.50 | ¾" meter |
| | $ 40.70 | $ 24.94 | - | $ 15.76 | 1" meter |
| | $ 54.26 | $ 33.25 | - | $ 21.01 | 1½" meter |
| | $ 67.84 | $ 41.57 | - | $ 26.27 | 2" meter |
| | $ 94.98 | $ 58.21 | - | $ 36.77 | 3" meter |
| | $ 122.11 | $ 74.83 | - | $ 47.28 | 4" meter |
| | $ 176.39 | $ 108.09 | - | $ 68.30 | 6" meter |
| | $ 230.62 | $ 141.37 | - | $ 89.25 | 8" meter |
| | $ 284.89 | $ 174.64 | - | $ 110.25 | 10" meter |

| | | |
|---|---|---|
| Construction Water Charges: | | Ref. PWD Policy W-7 |
| Water | $ 0.760 | per 100 cu. ft. (approx. $1.016 per 1,000 gal.) |
| 6" Meter Deposit | $ 5,000.00 | |
| Meter Rental (per day) | $ 1.00 | first 45 days |
| | $ 2.50 | during days 46 through 60 |
| | $ 5.00 | during days 61 through 90 |
| | $ 10.00 | days over 90 |

day count begins when meter is picked up at MSC
day count ends when meter is returned to MSC

(2) Outside of City Rates are 1.5 X the listed rates.
(3) ISR = Infrastructure Replacement Charge

$/acre

## 2008 RATES

| Crop Type | WID Base Rate | Outside Land Use Rate |
|---|---|---|
| Alfalfa | 55.38 | 67.08 |
| Clover/Pasture | 61.52 | 74.44 |
| Beans | 32.30 | 39.08 |
| Orchard | 47.68 | 57.70 |
| Peppers/Beets/Carrots | 47.68 | 57.70 |
| Tomato | 43.06 | 52.12 |
| Corn | 43.06 | 52.12 |
| Annuals | 43.06 | 52.12 |
| Vineyard | 36.92 | 44.66 |
| Rice/Pond | 116.90 | 141.44 |
| Cereal 1st | 15.38 | 18.62 |
| Cereal Additional | 7.70 | 9.32 |
| Asparagus | 30.76 | 37.22 |
| Minimum Rate | 55.00 | 66.56 |
| Metered Rate * | 15.98 | 19.34 |
| Drip Irrigation Metered | 10.00 | 12.10 |

* Rate 1 AF/A Minimum,
Meter Required by Landowner

Beaver Slough Off Season Rate - (10-% of Base Rate)
Irrigators in the Beaver Slough area who irrigate with the District water after the end of the season shall pay an additional charge equal to ten percent of the Beaver Slough base rate.

Construction Water - $2.50/1,000 gallons & $100.00 Non-Refundable Application fee.

2008 Irrigation Season Schedule Defined: Beginning May 1, 2008 or, thereof, and ending October 31, 2008 or sooner if the Mokelumne River supply runs out.

# Appendix L Lease Information for Existing Recycled Water Customers

L E A S E
FOR
AGRICULTURAL LAND
at
White Slough Water Pollution Control Facility

THIS LEASE, made and entered into this _____ day of _____, 2008, by and between the CITY OF LODI, a municipal corporation, hereinafter called Lessor, and LIMA RANCH hereinafter called Lessee.

W I T N E S S E T H :

1. PROPERTIES: That for and in consideration of the rents to be paid, and the covenants to be faithfully kept and performed by said Lessee, said Lessee does hereby lease, hire, and take from said Lessor, those certain properties described as follows:

   Those certain properties described in Exhibit A attached hereto, and by this reference made a part hereof. Property to be leased totals 218 acres ±.

2. EXTENSION: Although the current lease does not expire until December 31, 2008, it is a condition of this extension that Lessee agrees to apply the requirements of this lease extension in the final year of the current lease.

3. TERM: The term of this Lease shall be for a period of five (5) years, commencing January 1, 2008, and terminating at midnight on December 31, 2013. In order that the tenants have adequate time to plan their farming operations, bids for the lease of this property after December 31, 2013, will be called for approximately one year before that date.

4. RENT: In consideration of said Lease, Lessee agrees to pay to Lessor as rent for the demised premises based on the gross value of crops produced on the properties. The amount paid by Lessee shall be 20% of gross receipts for crops grown, including any deferred payments, credits, stock, or other compensation including crop insurance payments. If a crop is successfully produced but not sold, the value will be determined by similar sales by other tenants or market rates for the crops.

   Fallowed acreage shall be assessed a flat fee of $100.00 per acre in lieu of gross percentage. Planted acreage left unattended shall also be assessed a flat fee of $100.00 per acre.

   Lessee shall maintain adequate records of crop yields and gross receipts, and make such records available to Lessor for purposes of verification.

   For the purposes of this lease gross receipts shall mean the total revenue of any sort received by Lessee at sale of crop. No reduction of gross will be allowed for any cost incurred by Lessee due to planting, growing, harvesting, or hauling of crop. Any additional cost incurred by Lessee for services by others in conjunction with the above crop production practices will also not reduce gross receipts.

   Methods of verification may include any or all of the following; weigh tickets, sale receipts, and/or a contract for sale between Lessee and Broker. Lessee shall supply copies of weigh scale certification to verify accuracy of weight results. Lessor will be free to contact weigh facilities or purchasing agents from time to time as needed to verify quantities and sale amounts.

   Rental payments shall be made on or before June 1st of each year for the prior winter rotation crop and on or before December 1st of each year for the summer crops and shall be directed to the Public Works Department, 221 West Pine Street, P. O. Box 3006, Lodi, California, 95241-1910, for processing and shall be paid without prior notice or demand.

5. SECURITY: Tenant shall post security of $35,000 to secure its obligations under this agreement. The deposit shall be fully refundable upon Tenant's full satisfaction of the obligations hereunder. In the event Tenant defaults on any of its obligations, Landlord shall be entitled to deduct from the deposit for the full amount of its losses resulting from the default. The security may be in the form of a letter of credit, cash deposit, deed of trust or other form of security in such form and on such terms as is approved by the Lodi City Attorney's Office.

6. USE: The properties shall be used solely for the purpose of growing, cultivating, fertilizing, irrigating, and harvesting of agricultural crops while ensuring best farm practices, consistent with the terms of this lease, are maintained. During the term of this Lease it is understood and agreed by the parties hereto that Lessee shall be required to accept industrial wastewater, treated domestic effluent, and biosolids from City's White Slough Water Pollution Control Facility. Lessor will make available all excess domestic effluent, at no cost to the Lessee. It is further understood and agreed by Lessee, that Lessee must comply with all present and future laws, ordinances, rules, and regulations promulgated by any governmental authority of competent jurisdiction regulating the type of crops that can be grown on the properties during the lease term and any extension thereof. Lessee accepts the properties with the full understanding that the California Department of Health Services regulations (Title 22, Division 4), copy attached as Exhibit B, will limit Lessee to growing only fodder, fiber, or seed crops once industrial wastewater, treated domestic effluent, and biosolids are applied on the properties. Further, Lessee shall be permitted to use the properties for agricultural activities consistent with the terms of this Lease and as permitted by all governmental authorities, including but not limited to, the California Department of Health Services. Further, Lessee agrees to manage the irrigation of the properties with industrial wastewater, treated domestic effluent, and biosolids from the White Slough Facility in such a manner that it will not allow the discharge of any runoff to White Slough, other waters of the Delta, or adjacent private or public property, and meet all regulations imposed by all governmental authorities having proper jurisdiction, including but not limited to, the Central Valley Regional Water Quality Control Board. Lessee shall use and occupy said premises in a quiet, lawful, and orderly manner. Lessor and Lessee further agree that they shall permit no hunting, fishing, or public access to any part of the properties, including Lessee.

7. ACREAGE REQUIREMENTS AND FERTILIZER USE: Because the primary goal for the leased land is disposal of industrial wastewater, treated domestic effluent, and biosolids, in a manner that meets or exceeds regulatory requirements, it is necessary to define practices which will maximize this goal. To achieve the stated goal on a yearly basis it will henceforth be a requirement of the lease that 350 acres be planted to feed corn. To further maximize this effort a second crop of wheat or oats shall be planted after harvest of the corn. Because there are multiple leased parcels, the portion allotted to each Lessee may be increased or decreased by mutual agreement by tenants to maintain a minimum 350 acres of corn between the Lessees. To manage our goal it will be necessary for Lessee to submit an annual crop plan for each planting cycle along with the necessary harvesting and planting sheets. The plan will include crop type and acreage for each crop. It will also be necessary for Lessee to keep City staff apprised of irrigation and harvesting schedules. To better accomplish this notification, lessor shall install kiosks at several locations that lessee shall use to identify irrigation start and stop times, and harvest schedules for selected fields. Additionally, because loading rates for biosolids are determined by agronomic uptake of nitrogen for the crop, it will be necessary to better coordinate the field loading by ensuring the fields where biosolids are applied are loaded as equally and simultaneously as possible. The City will notify ahead of application days so that the irrigation system is available for this purpose. It will continue to be necessary to prohibit the application of any natural or chemical fertilizers or any other chemical without written approval of the Lessor. Lessor shall employ the services of a licensed agronomist to help City staff and lessee better manage farming practices to meet the desired goals of both parties.

8. AVAILABILITY OF LESSEE: Because of the type of operation of the White Slough Water Pollution Control Facility, it is imperative that Lessee or a representative be readily available in case plant personnel must change any plant operation. That representative must be able to understand and speak English. Lessee shall be responsible for keeping the City Public Works Department advised of a current telephone number and contact person(s) who can be reached 7 days a week, 24 hours a day.

9. REMEDIES ON DEFAULT: Should Lessee fail to pay any part of the rents herein specified at the times or in the manner provided, or fail to comply with or perform any other of the terms and provisions of the Lease on the part of Lessee to be performed or compiled with, then and in that event, Lessor may exercise any and all remedies provided by law or equity by reason of such default, including the right at Lessor's option, of terminating the Lease. In any of such events, Lessor shall be entitled to the immediate possession of said leased premises, and at their option, may enter into and upon said premises without notice to Lessee and exclude Lessee and all persons and all property therefrom, and by process of law or otherwise take and resume possession of said premises. Each and all of Lessor's remedies shall be construed as cumulative and none of them as exclusive of the other or as exclusive of any remedy provided by law or equity.

10. RELATIONSHIP OF PARTIES: It is understood and agreed that the relationship between the parties is that of landlord and tenant and not as a party or agent of Lessor. Lessee, or its subtenant, shall carry Worker's Compensation Insurance and observe all laws and regulations applicable to employers. A copy of Worker's Compensation insurance shall be on file in the Public Works Department.

11. DITCH, ROAD, AND PROPERTY MAINTENANCE: Lessee shall maintain and pay all costs of maintaining the irrigation lines, ditches, perimeter fences, and all access roads located on the properties. The perimeter fencing required by the State regulatory agencies will be maintained with material supplied by the City. All ditches and banks shall be kept free from weeds and other obstructions and have sufficient capacity to care for a reasonable head of water. In cases where ditches are not in proper condition to receive water, Lessor shall order the ditches cleaned and failure to do so will be sufficient cause for denial of water. Lessee shall further be responsible, at its sole cost and expense, for maintaining and repairing all improvements located on the properties, including but not limited to, wells, canals, drainage ditches, fences, and other improvements of any nature whatsoever located on the demised premises. Lessee will ensure no damage occurs to ground water monitoring wells located in or near farmed properties by tenant or their agents.

12. DELIVERY OF WATER: When the water supply and the capacity of the ditch is such that a rotation basis of delivery is necessary, a system of rotation may be utilized at the discretion of Lessor and may be changed in any section at the discretion of the Lessor. Lessor shall have full authority to stop water delivery if needed for plant operation or on account of any violation of the rules and regulations.

13. WASTE OF WATER: Any Lessee over irrigating or wasting water on roads, vacant lands or land previously irrigated, either willfully or carelessly or on account of defective or unclean ditches, poor equipment, or unleveled land to an unreasonable depth, will be refused the use of water until such conditions are remedied to the satisfaction of Lessor.

14. FLOOD RISK: Tenant acknowledges that he is fully acquainted with the demised premises, all facilities affecting the demised premises, and the possibility that the leased premises could be flooded from many causes including, without limitation, the following:

A. Levee overtopping and levee failure due to natural causes such as winds, tides, barometric pressure changes, rainfall or its runoff, earthquakes, levee settlement, and rodents.

B. Levee overtopping and levee failure due to man-related causes including negligence of Lessor, any reclamation district or improper levee maintenance, flood fighting and/or patrol, dredging, water releases, obstruction of water flows, and water diversions.

C. Failure of the drainage system due to natural or man-related causes including negligence of Lessor, any reclamation district, and other governmental agency.

D. Failure to construct, repair, maintain, or operate levees, drainage, or irrigation facilities, or other facilities, whether due to limited funding or otherwise.

E. Some localized flooding may occur as a result of Lessee being required to accept industrial wastewater, treated domestic effluent, and biosolids.

Tenant hereby expressly assumes the risk of damage arising out of the above and hereby waives the right (including the right on the part of any insurer through subrogation) to make any claim pertaining to the same as against the State of California, the United States, all reclamation districts, the counties, all other agencies of government, and Lessor and their officers, agents, and employees.

15. ASSIGNMENT AND SUBLETTING: Lessee shall not assign, encumber, convey, or otherwise hypothecate this Lease, in whole or any part, without first obtaining the written consent of Lessor. Lessee shall be permitted to sublet the properties to a responsible person, firm, or corporation, but any such subletting or use by another person, firm, or corporation shall in no way release Lessee from the obligation, conditions, and terms of this Lease. Lessor shall furnish in writing to Lessor the name of any subtenant, and any sublease entered into by Lessee shall incorporate the terms, provisions, and conditions of this Lease.

16. ENTRY BY LESSOR: Lessor shall have the right at all reasonable times during the term of this Lease to enter said leased premises for the purpose of examining or inspecting the same.

17. REPAIRS: Lessee shall be solely responsible for all repairs to the properties. Lessee shall notify Lessor, in writing, of any alterations or additions to the leased premises and major alterations or any alteration that would interfere with Lessor's wastewater discharges on the leased premises shall be first approved by Lessor before the same is made. All alterations, additions, or improvements made in, to, or on the demised premises shall, immediately upon the installation thereof, become and be the property of the Lessor and shall remain upon and be surrendered with the premises.

    Lessee shall be responsible to Lessor for all damages caused by willful neglect or careless acts and upon his failure to repair such damage after notification by Lesser, such repairs shall be made at his expense by Lessor.

18. ENFORCEMENT OF RULES: Refusal to comply with the rules and regulations, and the requirements hereof or the interference with the discharge of the duties of Lessor shall be sufficient cause for shutting off the water. Water will not again be furnished until full compliance with all requirements of the rules and regulations or contract agreement.

19. SURRENDER THE PREMISES: Lessee shall, at the termination of the term hereby created, or upon the earlier termination hereof for any reason, or upon the extension of the term herein set forth, quit and surrender said premises in good order, condition, and repair reasonable wear and tear and act of God or fire excepted.

20. FEES: Lessee shall pay all personal taxes, licenses fees, or other fees or taxes, levied by any governmental agency which may be imposed upon the business of Lessee or its subtenant which are attributable to Lessees use of the premises.

    If any of the above charges are assessed against the real property, and because of said assessment, the Lessor pays the same, which Lessor will have the right to do regardless of the validity of any such levy, the Lessee upon demand will repay to the Lessor all taxes and other assessments so levied against the Lessor which are due by the Lessee.

    Lessor shall pay all real estate taxes and fees for special district assessments of the real property.

21. UTILITIES: Lessee agrees to pay, during the term hereof, all utilities of any nature whatsoever used upon said leased premises except for the run-off collection system located on the property. In the event Lessee creates excessive runoff by over irrigation, Lessee may be required to pay the cost of runoff collection.

22. WASTE: Lessee shall not maintain or commit, nor suffer to be maintained or committed, any nuisance or waste in or about said leased premises, nor do or permit anything to be done in or about said premises, nor keep anything therein, which will in any way conflict with any law, ordinance, rule, or regulation affecting the occupancy and use of said premises, which have been or may hereafter be enacted or promulgated by any public authority.

23. MECHANIC'S LIEN: Lessee agrees to keep said premises free from all liens and claims of mechanics, laborers, material suppliers, and others for work done, and material furnished, and Lessee shall not create or suffer to be created any lien or encumbrance on said premises.

24. PUBLIC LIABILITY AND PROPERTY DAMAGE INSURANCE: Lessee agrees to indemnify and hold harmless Lessor from and against all claims of whatever nature arising from any act, omission, or negligence of Lessee or Lessee's contractors, licensees, agents, servants, or employees, or arising from any accident, injury, or damage whatsoever caused any person, or to the property of any person, occurring during the term thereof, in or about the demised premises where such accident, damage, or injury, including death, or is claimed to have resulted, from any act or omission on the part of Lessee or Lessee's agents or employees. This indemnity and hold harmless agreement shall include indemnity against all costs and expenses, including attorney's fees incurred in or in connection with any such claim or proceeding brought thereon and the defense thereof. Lessee agrees to maintain in full force during the term hereof a policy of public liability insurance under which the Lessee is named as insured, and containing an additional named insured endorsement naming City of Lodi, its Elected and Appointed Boards, Commissions, Officers, Agents and Employees as additional insured, and under which the insurer agrees to indemnify and hold Lessee and Lessor harmless from and against all costs, expenses, and liability arising out of, or based upon, any and all property damage, or damages for personal injuries, including death, sustained in accidents occurring in or about the demised premises, where such accident, damage, or injury, including death, results, or is claimed to have resulted, from any act or omission on the part of Lessee, or Lessee's agents or employees. The minimum limits of such insurance shall be $1,000,000.00 (One Million Dollars) per occurrence. In addition to the additional named insured endorsement on Lessee's policy of insurance, said insurance policy shall be endorsed to include the following language:

    > "Such insurance as is afforded by the endorsement for additional insureds shall apply as primary insurance. Any other insurance maintained by the City of Lodi and Appointed Boards, Commissions, Officers, Agents, Employees, and Volunteers shall be excess only and not contributing with the coinsurance afforded by this endorsement."

A duplicate or certificate of said public liability and property damage insurance policy containing the above-stated required endorsements shall be delivered to Lessor within ten (10) days after the issuance and each renewal of said policy. This paragraph, and all other provisions of this Lease, shall apply and be construed as applying to any subtenant of Lessee.

25. BANKRUPTCY, RECEIVERSHIP, AND INSOLVENCY: If Lessee should make a general assignment for the benefit of creditors, or file a voluntary petition in bankruptcy, or be adjudicated bankrupt or insolvent, or permit a receiver to be appointed to take possession of a substantial portion of its assets or of this leasehold, and such bankruptcy, insolvency, or receivership proceeding shall not be dismissed within ninety (90) days, then Lessor may, without notice or demand, terminate this Lease and forthwith reenter and repossess the properties, and remove all persons therefrom, and under no circumstances shall this Lease be assignable or transferable by operation of law.

26. EMINENT DOMAIN: If the whole or any portion of the premises hereby leased shall be taken by any public authority under the power of eminent domain, whether by negotiation or otherwise, then the term of this Lease shall cease as of the date possession is taken by such authority as to that portion taken, and the rental thereafter due or payable shall be reduced for the portion taken at the rental rate per acre then in effect. All damages awarded for such taking under the power of eminent domain, whether for the whole or a part of the leased premises, shall be the property of Lessor. Provided, however, that Lessor shall not be entitled to any award made to Lessee for loss of business, business leasehold improvements, and crops.

27. ATTORNEY'S FEES: In each suit brought for the recovery of any rent due hereunder, or for the recovery of the possession of said demised premises, or for the breach, or to restrain the breach, of any of the terms, conditions, or covenants of this Lease, the prevailing party shall be entitled to a reasonable sum as and for attorney's fees therein, the amount of which shall be determined by the court in such suit and added to and become a part of the judgment therein.

28. WAIVER: Failure of Lessor to insist upon performance of any of the terms or conditions of this Lease in any one or more instances shall in no event be construed as a waiver or a relinquishment of its right to future performance thereof, and Lessee's obligations to such future performance shall continue in full force and effect. The receipt by Lessor of rent, with the knowledge of the breach of any agreement or condition hereof, shall not be determined to be a waiver of any such breach.

29. ACCEPTANCE OF LEASEHOLD ESTATE: Lessee has examined the leased premises, knows the conditions thereof, and accepts possession thereof in their condition.

30. TERMINATION OF LEASE:

    A. By Lessee. Lessee shall be permitted to terminate this Lease at its option in the event governmental laws, rules, or regulations, including, but not limited to, those promulgated by the California Regional Water Quality Control Board or the California Department of Health Services, prohibit the growing of any crop on the properties. In the event Lessee terminates this Lease as provided above, crop payments shall be due for crops harvested prior to the date of termination.

    Lessee shall also be permitted to terminate this Lease for any reason whatsoever if written notice is given to Lessor six (6) months prior to the end of any individual year covered under this lease. Lessee shall be responsible for all crop payments due for the entire calendar year in which such notice is given.

B. By Lessor. Lessor may terminate this lease if it determines, in its sole discretion, that the demised premises are necessary for any City function or any other purpose approved by the City Council. In such cases, the Lessor shall give to the Lessee six (6) months written notice thereof, and crop payments shall be due for crops harvested prior to date of termination.

31. ACCESS: Lessee shall be permitted reasonable access over adjacent City property owned by Lessor for ingress and egress purposes.

32. CONTRACT: This written agreement constitutes the entire contract between the Lessee and Lessor, and no representation or agreement, unless expressed herein, shall be binding on the Lessor or Lessee.

33. BINDING ON HEIRS: This Lease shall include and inure to and bind the heirs, executors, administrators, successors, and assigns of the respective parties hereto, but nothing in this paragraph contained shall be construed to modify or impair in any manner any of the provisions and restrictions of this Lease relating to the assignment of this Lease, or of any interest therein, or to the subletting or underletting of said leased premises or any part thereof.

IN WITNESS WHEREOF, Lessor and Lessee have executed this Lease on the date and year first above written.

CITY OF LODI, a municipal corporation
Hereinabove called "Lessor"

By_____
BLAIR KING, City Manager

Hereinabove called "Lessee"

By_____
LIMA RANCH

_____
RANDY JOHL
City Clerk

Approved as to Form:

_____
D. STEPHEN SCHWABAUER
City Attorney

L E A S E
FOR
AGRICULTURAL LAND
at
White Slough Water Pollution Control Facility

THIS LEASE, made and entered into this _____ day of _____, 2008, by and between the CITY OF LODI, a municipal corporation, hereinafter called Lessor, and KIRSCHENMEN FARMS hereinafter called Lessee.

W I T N E S S E T H :

1. PROPERTIES: That for and in consideration of the rents to be paid, and the covenants to be faithfully kept and performed by said Lessee, said Lessee does hereby lease, hire, and take from said Lessor, those certain properties described as follows:

   Those certain properties described in Exhibit A attached hereto, and by this reference made a part hereof. Property to be leased totals 659 acres ±.

2. EXTENSION: Although the current lease does not expire until December 31, 2008, it is a condition of this extension that Lessee agrees to apply the requirements of this lease extension in the final year of the current lease.

3. TERM: The term of this Lease shall be for a period of five (5) years, commencing January 1, 2008, and terminating at midnight on December 31, 2013. In order that the tenants have adequate time to plan their farming operations, bids for the lease of this property after December 31, 2013, will be called for approximately one year before that date.

4. RENT: In consideration of said Lease, Lessee agrees to pay to Lessor as rent for the demised premises based on the gross value of crops produced on the properties. The amount paid by Lessee shall be 20% of gross receipts for crops grown, including any deferred payments, credits, stock, or other compensation including crop insurance payments. If a crop is successfully produced but not sold, the value will be determined by similar sales by other tenants or market rates for the crops.

   Fallowed acreage shall be assessed a flat fee of $100.00 per acre in lieu of gross percentage. Planted acreage left unattended shall also be assessed a flat fee of $100.00 per acre.

   Lessee shall maintain adequate records of crop yields and gross receipts, and make such records available to Lessor for purposes of verification.

   For the purposes of this lease gross receipts shall mean the total revenue of any sort received by Lessee at sale of crop. No reduction of gross will be allowed for any cost incurred by Lessee due to planting, growing, harvesting, or hauling of crop. Any additional cost incurred by Lessee for services by others in conjunction with the above crop production practices will also not reduce gross receipts.

   Methods of verification may include any or all of the following; weigh tickets, sale receipts, and/or a contract for sale between Lessee and Broker. Lessee shall supply copies of weigh scale certification to verify accuracy of weight results. Lessor will be free to contact weigh facilities or purchasing agents from time to time as needed to verify quantities and sale amounts.

   Rental payments shall be made on or before June 1st of each year for the prior winter rotation crop and on or before December 1st of each year for the summer crops and shall be directed to the Public Works Department, 221 West Pine Street, P. O. Box 3006, Lodi, California, 95241-1910, for processing and shall be paid without prior notice or demand.

5. SECURITY: Tenant shall post security of $75,000 to secure its obligations under this agreement. The deposit shall be fully refundable upon Tenant's full satisfaction of the obligations hereunder. In the event Tenant defaults on any of its obligations, Landlord shall be entitled to deduct from the deposit for the full amount of its losses resulting from the default. The security may be in the form of a letter of credit, cash deposit, deed of trust or other form of security in such form and on such terms as is approved by the Lodi City Attorney's Office.

6. USE: The properties shall be used solely for the purpose of growing, cultivating, fertilizing, irrigating, and harvesting of agricultural crops while ensuring best farm practices, consistent with the terms of this lease, are maintained. During the term of this Lease it is understood and agreed by the parties hereto that Lessee shall be required to accept industrial wastewater, treated domestic effluent, and biosolids from City's White Slough Water Pollution Control Facility. Lessor will make available all excess domestic effluent, at no cost to the Lessee. It is further understood and agreed by Lessee, that Lessee must comply with all present and future laws, ordinances, rules, and regulations promulgated by any governmental authority of competent jurisdiction regulating the type of crops that can be grown on the properties during the lease term and any extension thereof. Lessee accepts the properties with the full understanding that the California Department of Health Services regulations (Title 22, Division 4), copy attached as Exhibit B, will limit Lessee to growing only fodder, fiber, or seed crops once industrial wastewater, treated domestic effluent, and biosolids are applied on the properties. Further, Lessee shall be permitted to use the properties for agricultural activities consistent with the terms of this Lease and as permitted by all governmental authorities, including but not limited to, the California Department of Health Services. Further, Lessee agrees to manage the irrigation of the properties with industrial wastewater, treated domestic effluent, and biosolids from the White Slough Facility in such a manner that it will not allow the discharge of any runoff to White Slough, other waters of the Delta, or adjacent private or public property, and meet all regulations imposed by all governmental authorities having proper jurisdiction, including but not limited to, the Central Valley Regional Water Quality Control Board. Lessee shall use and occupy said premises in a quiet, lawful, and orderly manner. Lessor and Lessee further agree that they shall permit no hunting, fishing, or public access to any part of the properties, including Lessee.

7. ACREAGE REQUIREMENTS AND FERTILIZER USE: Because the primary goal for the leased land is disposal of industrial wastewater, treated domestic effluent, and biosolids, in a manner that meets or exceeds regulatory requirements, it is necessary to define practices which will maximize this goal. To achieve the stated goal on a yearly basis it will henceforth be a requirement of the lease that 350 acres be planted to feed corn. To further maximize this effort a second crop of wheat or oats shall be planted after harvest of the corn. Because there are multiple leased parcels, the portion allotted to each Lessee may be increased or decreased by mutual agreement by tenants to maintain a minimum 350 acres of corn between the Lessees. To manage our goal it will be necessary for Lessee to submit an annual crop plan for each planting cycle along with the necessary harvesting and planting sheets. The plan will include crop type and acreage for each crop. It will also be necessary for Lessee to keep City staff apprised of irrigation and harvesting schedules. To better accomplish this notification, lessor shall install kiosks at several locations that lessee shall use to identify irrigation start and stop times, and harvest schedules for selected fields. Additionally, because loading rates for biosolids are determined by agronomic uptake of nitrogen for the crop, it will be necessary to better coordinate the field loading by ensuring the fields where biosolids are applied are loaded as equally and simultaneously as possible. The City will notify ahead of application days so that the irrigation system is available for this purpose. It will continue to be necessary to prohibit the application of any natural or chemical fertilizers or any other chemical without written approval of the Lessor. Lessor shall employ the services of a licensed agronomist to help City staff and lessee better manage farming practices to meet the desired goals of both parties.

8. AVAILABILITY OF LESSEE: Because of the type of operation of the White Slough Water Pollution Control Facility, it is imperative that Lessee or a representative be readily available in case plant personnel must change any plant operation. That representative must be able to understand and speak English. Lessee shall be responsible for keeping the City Public Works Department advised of a current telephone number and contact person(s) who can be reached 7 days a week, 24 hours a day.

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10. RELATIONSHIP OF PARTIES: It is understood and agreed that the relationship between the parties is that of landlord and tenant and not as a party or agent of Lessor. Lessee, or its subtenant, shall carry Worker's Compensation Insurance and observe all laws and regulations applicable to employers. A copy of Worker's Compensation insurance shall be on file in the Public Works Department.

11. DITCH, ROAD, AND PROPERTY MAINTENANCE: Lessee shall maintain and pay all costs of maintaining the irrigation lines, ditches, perimeter fences, and all access roads located on the properties. The perimeter fencing required by the State regulatory agencies will be maintained with material supplied by the City. All ditches and banks shall be kept free from weeds and other obstructions and have sufficient capacity to care for a reasonable head of water. In cases where ditches are not in proper condition to receive water, Lessor shall order the ditches cleaned and failure to do so will be sufficient cause for denial of water. Lessee shall further be responsible, at its sole cost and expense, for maintaining and repairing all improvements located on the properties, including but not limited to, wells, canals, drainage ditches, fences, and other improvements of any nature whatsoever located on the demised premises. Lessee will ensure no damage occurs to ground water monitoring wells located in or near farmed properties by tenant or their agents.

12. DELIVERY OF WATER: When the water supply and the capacity of the ditch is such that a rotation basis of delivery is necessary, a system of rotation may be utilized at the discretion of Lessor and may be changed in any section at the discretion of the Lessor. Lessor shall have full authority to stop water delivery if needed for plant operation or on account of any violation of the rules and regulations.

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A. Levee overtopping and levee failure due to natural causes such as winds, tides, barometric pressure changes, rainfall or its runoff, earthquakes, levee settlement, and rodents.

B. Levee overtopping and levee failure due to man-related causes including negligence of Lessor, any reclamation district or improper levee maintenance, flood fighting and/or patrol, dredging, water releases, obstruction of water flows, and water diversions.

C. Failure of the drainage system due to natural or man-related causes including negligence of Lessor, any reclamation district, and other governmental agency.

D. Failure to construct, repair, maintain, or operate levees, drainage, or irrigation facilities, or other facilities, whether due to limited funding or otherwise.

E. Some localized flooding may occur as a result of Lessee being required to accept industrial wastewater, treated domestic effluent, and biosolids.

Tenant hereby expressly assumes the risk of damage arising out of the above and hereby waives the right (including the right on the part of any insurer through subrogation) to make any claim pertaining to the same as against the State of California, the United States, all reclamation districts, the counties, all other agencies of government, and Lessor and their officers, agents, and employees.

15. ASSIGNMENT AND SUBLETTING: Lessee shall not assign, encumber, convey, or otherwise hypothecate this Lease, in whole or any part, without first obtaining the written consent of Lessor. Lessee shall be permitted to sublet the properties to a responsible person, firm, or corporation, but any such subletting or use by another person, firm, or corporation shall in no way release Lessee from the obligation, conditions, and terms of this Lease. Lessor shall furnish in writing to Lessor the name of any subtenant, and any sublease entered into by Lessee shall incorporate the terms, provisions, and conditions of this Lease.

16. ENTRY BY LESSOR: Lessor shall have the right at all reasonable times during the term of this Lease to enter said leased premises for the purpose of examining or inspecting the same.

17. REPAIRS: Lessee shall be solely responsible for all repairs to the properties. Lessee shall notify Lessor, in writing, of any alterations or additions to the leased premises and major alterations or any alteration that would interfere with Lessor's wastewater discharges on the leased premises shall be first approved by Lessor before the same is made. All alterations, additions, or improvements made in, to, or on the demised premises shall, immediately upon the installation thereof, become and be the property of the Lessor and shall remain upon and be surrendered with the premises.

    Lessee shall be responsible to Lessor for all damages caused by willful neglect or careless acts and upon his failure to repair such damage after notification by Lesser, such repairs shall be made at his expense by Lessor.

18. ENFORCEMENT OF RULES: Refusal to comply with the rules and regulations, and the requirements hereof or the interference with the discharge of the duties of Lessor shall be sufficient cause for shutting off the water. Water will not again be furnished until full compliance with all requirements of the rules and regulations or contract agreement.

19. SURRENDER THE PREMISES: Lessee shall, at the termination of the term hereby created, or upon the earlier termination hereof for any reason, or upon the extension of the term herein set forth, quit and surrender said premises in good order, condition, and repair reasonable wear and tear and act of God or fire excepted.

20. FEES: Lessee shall pay all personal taxes, licenses fees, or other fees or taxes, levied by any governmental agency which may be imposed upon the business of Lessee or its subtenant which are attributable to Lessees use of the premises.

    If any of the above charges are assessed against the real property, and because of said assessment, the Lessor pays the same, which Lessor will have the right to do regardless of the validity of any such levy, the Lessee upon demand will repay to the Lessor all taxes and other assessments so levied against the Lessor which are due by the Lessee.

    Lessor shall pay all real estate taxes and fees for special district assessments of the real property.

21. UTILITIES: Lessee agrees to pay, during the term hereof, all utilities of any nature whatsoever used upon said leased premises except for the run-off collection system located on the property. In the event Lessee creates excessive runoff by over irrigation, Lessee may be required to pay the cost of runoff collection.

22. WASTE: Lessee shall not maintain or commit, nor suffer to be maintained or committed, any nuisance or waste in or about said leased premises, nor do or permit anything to be done in or about said premises, nor keep anything therein, which will in any way conflict with any law, ordinance, rule, or regulation affecting the occupancy and use of said premises, which have been or may hereafter be enacted or promulgated by any public authority.

23. MECHANIC'S LIEN: Lessee agrees to keep said premises free from all liens and claims of mechanics, laborers, material suppliers, and others for work done, and material furnished, and Lessee shall not create or suffer to be created any lien or encumbrance on said premises.

24. PUBLIC LIABILITY AND PROPERTY DAMAGE INSURANCE: Lessee agrees to indemnify and hold harmless Lessor from and against all claims of whatever nature arising from any act, omission, or negligence of Lessee or Lessee's contractors, licensees, agents, servants, or employees, or arising from any accident, injury, or damage whatsoever caused any person, or to the property of any person, occurring during the term thereof, in or about the demised premises where such accident, damage, or injury, including death, or is claimed to have resulted, from any act or omission on the part of Lessee or Lessee's agents or employees. This indemnity and hold harmless agreement shall include indemnity against all costs and expenses, including attorney's fees incurred in or in connection with any such claim or proceeding brought thereon and the defense thereof. Lessee agrees to maintain in full force during the term hereof a policy of public liability insurance under which the Lessee is named as insured, and containing an additional named insured endorsement naming City of Lodi, its Elected and Appointed Boards, Commissions, Officers, Agents and Employees as additional insured, and under which the insurer agrees to indemnify and hold Lessee and Lessor harmless from and against all costs, expenses, and liability arising out of, or based upon, any and all property damage, or damages for personal injuries, including death, sustained in accidents occurring in or about the demised premises, where such accident, damage, or injury, including death, results, or is claimed to have resulted, from any act or omission on the part of Lessee, or Lessee's agents or employees. The minimum limits of such insurance shall be $1,000,000.00 (One Million Dollars) per occurrence. In addition to the additional named insured endorsement on Lessee's policy of insurance, said insurance policy shall be endorsed to include the following language:

    > "Such insurance as is afforded by the endorsement for additional insureds shall apply as primary insurance. Any other insurance maintained by the City of Lodi and Appointed Boards, Commissions, Officers, Agents, Employees, and Volunteers shall be excess only and not contributing with the coinsurance afforded by this endorsement."

A duplicate or certificate of said public liability and property damage insurance policy containing the above-stated required endorsements shall be delivered to Lessor within ten (10) days after the issuance and each renewal of said policy. This paragraph, and all other provisions of this Lease, shall apply and be construed as applying to any subtenant of Lessee.

25. BANKRUPTCY, RECEIVERSHIP, AND INSOLVENCY: If Lessee should make a general assignment for the benefit of creditors, or file a voluntary petition in bankruptcy, or be adjudicated bankrupt or insolvent, or permit a receiver to be appointed to take possession of a substantial portion of its assets or of this leasehold, and such bankruptcy, insolvency, or receivership proceeding shall not be dismissed within ninety (90) days, then Lessor may, without notice or demand, terminate this Lease and forthwith reenter and repossess the properties, and remove all persons therefrom, and under no circumstances shall this Lease be assignable or transferable by operation of law.

26. EMINENT DOMAIN: If the whole or any portion of the premises hereby leased shall be taken by any public authority under the power of eminent domain, whether by negotiation or otherwise, then the term of this Lease shall cease as of the date possession is taken by such authority as to that portion taken, and the rental thereafter due or payable shall be reduced for the portion taken at the rental rate per acre then in effect. All damages awarded for such taking under the power of eminent domain, whether for the whole or a part of the leased premises, shall be the property of Lessor. Provided, however, that Lessor shall not be entitled to any award made to Lessee for loss of business, business leasehold improvements, and crops.

27. ATTORNEY'S FEES: In each suit brought for the recovery of any rent due hereunder, or for the recovery of the possession of said demised premises, or for the breach, or to restrain the breach, of any of the terms, conditions, or covenants of this Lease, the prevailing party shall be entitled to a reasonable sum as and for attorney's fees therein, the amount of which shall be determined by the court in such suit and added to and become a part of the judgment therein.

28. WAIVER: Failure of Lessor to insist upon performance of any of the terms or conditions of this Lease in any one or more instances shall in no event be construed as a waiver or a relinquishment of its right to future performance thereof, and Lessee's obligations to such future performance shall continue in full force and effect. The receipt by Lessor of rent, with the knowledge of the breach of any agreement or condition hereof, shall not be determined to be a waiver of any such breach.

29. ACCEPTANCE OF LEASEHOLD ESTATE: Lessee has examined the leased premises, knows the conditions thereof, and accepts possession thereof in their condition.

30. TERMINATION OF LEASE:

    A. By Lessee. Lessee shall be permitted to terminate this Lease at its option in the event governmental laws, rules, or regulations, including, but not limited to, those promulgated by the California Regional Water Quality Control Board or the California Department of Health Services, prohibit the growing of any crop on the properties. In the event Lessee terminates this Lease as provided above, crop payments shall be due for crops harvested prior to the date of termination.

    Lessee shall also be permitted to terminate this Lease for any reason whatsoever if written notice is given to Lessor six (6) months prior to the end of any individual year covered under this lease. Lessee shall be responsible for all crop payments due for the entire calendar year in which such notice is given.

B. By Lessor. Lessor may terminate this lease if it determines, in its sole discretion, that the demised premises are necessary for any City function or any other purpose approved by the City Council. In such cases, the Lessor shall give to the Lessee six (6) months written notice thereof, and crop payments shall be due for crops harvested prior to date of termination.

31. ACCESS: Lessee shall be permitted reasonable access over adjacent City property owned by Lessor for ingress and egress purposes.

32. CONTRACT: This written agreement constitutes the entire contract between the Lessee and Lessor, and no representation or agreement, unless expressed herein, shall be binding on the Lessor or Lessee.

33. BINDING ON HEIRS: This Lease shall include and inure to and bind the heirs, executors, administrators, successors, and assigns of the respective parties hereto, but nothing in this paragraph contained shall be construed to modify or impair in any manner any of the provisions and restrictions of this Lease relating to the assignment of this Lease, or of any interest therein, or to the subletting or underletting of said leased premises or any part thereof.

IN WITNESS WHEREOF, Lessor and Lessee have executed this Lease on the date and year first above written.

CITY OF LODI, a municipal corporation
Hereinabove called "Lessor"

By_____
BLAIR KING, City Manager

Hereinabove called "Lessee"

By_____
KIRSCHENMEN FARMS

_____
RANDY JOHL
City Clerk

Approved as to Form:

_____
D. STEPHEN SCHWABAUER
City Attorney

RECEIVED
MAY 2 2008
CITY OF LODI
PUBLIC WORKS DEPARTMENT

RECEIVED
FEB 24 1993
CITY OF LODI
PUBLIC WORKS DEPARTMENT

RECEIVED
FEB 26 1993
CITY OF LODI
MUNICIPAL SERVICE CENTER

# GROUND LEASE

by and between

THE CITY OF LODI

(Landlord)

and

NORTHERN CALIFORNIA POWER AGENCY

(Tenant)

# GROUND LEASE

THIS LEASE, entered into this 17TH day of FEBRUARY, 1993, by and between the CITY OF LODI, a municipal corporation ("Landlord"), and NORTHERN CALIFORNIA POWER AGENCY ("Tenant").

1. Premises. Landlord leases to Tenant and Tenant leases from Landlord that real property in the City of Lodi, County of San Joaquin, California, described in Exhibit A attached hereto and made a part hereof. The premises leased to Tenant are referred to in this Lease as the "Leased Premises" or the "Premises."

2. Use. Tenant shall have the use of the Leased premises for the purpose of the construction, operation and maintenance of a gas turbine power generation plant and incidental ancillary uses (the "Project"), and for any other lawful purpose.

3. Term; Extension. The term of this Lease shall commence on January 1, 1993 ("Commencement Date"), and shall terminate, unless earlier terminated in accordance with the provisions of this Lease, on a date fifty (50) years from the Commencement Date. Tenant's right to exclusive possession shall commence on the Commencement Date. Tenant shall have the right to extend the term of this Lease on all the terms and conditions set forth herein for an additional period of fifty (50) years, to be exercised by written notice to Landlord during the last year of the initial term of this Lease.

4. Rent.

(A) Monthly Rent. Rent payments will begin on a monthly basis on the Commencement Date. Tenant shall pay to Landlord rent on or

keep Landlord apprised of the volume and nature of truck traffic upon the demised premises.

(B) Landlord shall not be obligated to make any changes, alterations, additions or repairs in, on or about the Leased Premises or any part hereof or any improvements installed thereon. Tenant waives all provisions of law that may impose a duty of repair on Landlord.

(C) Tenant shall indemnify and save harmless Landlord against all actions, claims and damages by reason of (1) Tenant's failure to perform the terms of this paragraph, or (2) Tenant's nonobservance or nonperformance of any law, ordinance or regulation applicable to the Leased Premises, and any liability or duty to repair imposed by the laws of California.

(D) Tenant agrees to construct a perimeter fence around the Leased Premises according to the attached specification.

7. Mechanic's Liens.

(A) Covenant Against Liens and Claims. Tenant shall not allow or permit to be enforced against the Leased Premises or any part thereof, any mechanic's, materialmen's, contractor's or subcontractor's liens arising from any claim growing out of work of any construction, repair, restoration, operation, replacement or improvement, or any other claim or demand no matter how the same may arise. Tenant shall pay or cause to be paid all of said liens, claims or demands before any lawsuit is brought to enforce them against the Leased Premises. Tenant agrees to indemnify and hold the Landlord and the Leased Premises free and harmless from all liability for any and all such liens, claims and demands, together with reasonable attorneys' fees and all costs and expenses incurred by Landlord in connection therewith.

paid. Any default in such repayment by Tenant shall constitute a breach of the covenants and conditions of this Lease.

8. Insurance and Indemnity.

(A) Landlord's Nonliability. Landlord shall not be liable for any loss, damage or injury of any kind to any person or property arising from any use of the Leased Premises, or any part thereof, or caused by any defect in any building, structure or other improvement thereon or in any equipment or other facility therein, or caused by or arising from any act or omission of Tenant or any of its agents, employees, licensees or invitees, or by or from any accident on the Leased Premises or any fire or other casualty thereon, or occasioned by the failure of Tenant to maintain the Leased Premises and all improvements thereto in a safe condition, or arising from any other cause except where caused by the negligence of Landlord, its agents or employees.

(B) Indemnification of Landlord. Notwithstanding anything to the contrary contained in this Lease, and irrespective of any insurance carried by Tenant for the benefit of Landlord under the terms of this Lease, Tenant agrees to protect, indemnity and hold the Landlord and the Leased Premises harmless from any and all damages and liabilities at any time occasioned by or arising out of (1) any act, activity or omission of Tenant, or of anyone holding under Tenant, or (2) the occupancy or use of the Leased Premises or any part thereof, by or under Tenant, or (3) any state or condition of the Leased Premises or any part thereof.

(C) Liability Insurance. Tenant shall procure and maintain at all times during the term of this Lease, at its sole cost and expense, a policy or policies of commercial public liability insurance by the terms of which

election, upon ten (10) days advance written notice, to procure and maintain such insurance. The premiums paid by Landlord shall be treated as added rent due from Tenant with interest at the Bank of America prime rate, to be paid within thirty (30) days of demand. Landlord shall give prompt notice of the payments of such premiums, stating the amounts paid and the names of the insurer or insurers.

(F) Waiver of Subrogation. The parties hereby release each other, and their respective representatives, from any claims for damage to any person or to the Premises and the improvements which may be located upon the Premises and to the fixtures, personal property, tenant's improvements and alterations of tenant in or on the Premises and the improvements which may be located upon the Premises that are caused by or result from risks insured against under any insurance policies carried by the parties hereto and in force at the time of any such damage. Each party hereto shall cause each insurance policy obtained by it to provide that the insurance company waives all right of recovery by way of subrogation against either party in connection with any damage covered by any policy, provided obtaining such a waiver in each such policy is then available at a reasonable charge. Neither party hereto shall be liable to the other for any damage caused by fire or any of the risks insured against under any insurance policy required by this Lease.

9. Landlord's Covenants.

(A) Water Supply. Landlord shall make available to Tenant a minimum of 550,000 gallons per day of reclaimed water from the White Slough Treatment Plant.

(C) Failure to maintain the Leased Premises or cause the same to be maintained as provided for in this Lease;

(D) Abandonment of the Leased Premises after completion of construction for a continuous period of one hundred twenty (120) days; or

(E) Failure to perform or breach of any other covenant, condition or restriction provided for in this Lease.

13. Remedies in Event of Default. Upon any default of Tenant, and in the event the said default is due to the failure of Tenant to make the payment of any installment of rent or other sum when due, and in the event Tenant shall fail to remedy such default within ten (10) days after written notice to do so, or upon any other default by Tenant, and in the event that Tenant shall fail to remedy such other default within thirty (30) days after written notice from Landlord so to do specifying the nature of such default, or if such default cannot be cured within thirty (30) days, Tenant has not commenced corrective action and prosecuted the same to completion with due diligence, or in the event that the default is of such a nature that it cannot be cured by any action of Tenant, then and in any of these events, in addition to any other remedy Landlord may have by operation of law, Landlord shall have the right but not the obligation without any further demand or notice to reenter the Leased Premises and eject all persons from the Leased Premises, using due process of law, and immediately terminate Tenant's right to possession of the Premises, and repossess the same by summary proceedings or other appropriate action, and Landlord shall thereupon be entitled to receive from Tenant all damages allowed by law.

of this Lease. Any improvements remaining on the Premises after expiration or sooner termination of the Lease shall become the property of Landlord.

16. Miscellaneous.

(A) Attorneys' Fees. In the event any action is brought by Landlord to recover any rent due and unpaid hereunder or to recover possession of the Leased Premises, or in the event any action is brought by Landlord or Tenant against the other to enforce or for the breach of any of the terms, covenants or conditions contained in this Lease, the prevailing party shall be entitled to recover reasonable attorneys' fees to be fixed by the Court, together with costs of suit therein incurred.

(B) Waiver. No waiver of any breach of any of the terms, covenants, agreements, restrictions or conditions of this Lease shall be construed as a waiver of any succeeding breach of the same or other covenants, agreements, restrictions and conditions hereof. No delay or omission of Landlord to exercise any right or remedy shall be construed as a waiver of any such right or remedy or of any default by Tenant under this Lease. The various rights and remedies reserved to Landlord herein including those not specifically described in this Lease shall be cumulative and, except as otherwise provided by California statutory law in force at the time of execution of this Lease, Landlord may pursue any or all of such rights and remedies whether at the same time or otherwise.

(C) Holding Over. If Tenant shall hold over the Leased Premises after the expiration of the term hereof with the consent of Landlord, either express or implied, such holding over shall be construed to be only a tenancy from month to month, subject to all the covenants, conditions and

agreed that Landlord does not in any way nor for any purpose become a partner of Tenant or a joint venturer with Tenant in the conduct of Tenant's business or otherwise, except as provided by the Phase 2 and Phase 3 combustion turbine project number 2 agreements.

(H) Time of the Essence. Time is expressly declared to be of the essence of this Lease.

(I) Memorandum of Lease. This Lease shall not be recorded, but the parties agree to execute and deliver a Memorandum of this Lease in recordable form, which Memorandum shall be recorded.

(J) Quitclaim. At the expiration or earlier termination of this Lease, Tenant shall execute, acknowledge and deliver to Landlord within five (5) days after written demand from Landlord to Tenant any quitclaim deed or other document required by any reputable title company to remove the cloud of this Lease from the real property subject to this Lease.

(K) Number and Gender. Whenever the singular number is used in this Lease and when required by the context, the same shall include the plural, and the masculine gender shall include the feminine and neuter genders, and the word "person" shall include corporation, firm or association. If there is more than one Tenant, the obligations imposed under this Lease upon Tenant shall be joint and several.

(L) Headings and Titles. The marginal headings or titles to the paragraphs of this Lease are not a part of this Lease and shall have no effect upon the construction or interpretation of any part of this Lease.

(M) Entire Agreement. This Lease contains the entire agreement of the parties hereto with respect to the matters covered hereby,

not expressly contained herein shall in no way bind either Tenant or Landlord. Landlord and Tenant waive any right or rescission and all claims for damages by reason of any statement, representations, warranty, promise and agreement, if any, not contained in this Lease.

(P) Quiet Enjoyment. This Lease is subject and junior only to all existing easements, covenants, conditions and restrictions and other matters and encumbrances of record as of the date of this Lease. As long as Tenant is not in default of any provision of this Lease, Tenant shall have quiet enjoyment of the premises.

(Q) Termination. Tenant may terminate this Lease at any time upon six (6) months advance notice.

17. Payments and Notices. Any notice to be given or other document to be delivered by either party to the other party may be given by personal delivery or may be deposited in the United States mail in the State of California, duly registered or certified, with postage prepaid, and addressed to the party for whom intended as follows:

To Landlord:
Thomas A. Peterson
City Manager
221 West Pine Street
Lodi, CA 95240

To Tenant:
Northern California Power Agency
Attn: Assistant General Manager
180 Cirby Way
Roseville, CA 95678

Jack Sovern

Eitl :om time to time by written notice to the other part ddress which shall be substituted for the one specified above. It any notice or other document is sent by registered or

19. Abandonment and Closure of Injection Wells. Upon termination of this lease, Tenant, at its sole expense, shall provide for the abandonment and closure of any and all injection wells utilized on site by Tenant. Such abandonment shall be done in compliance with all applicable state and federal laws and regulations and under the direction of the California Department of Oil and Gas.

This Ground Lease has been executed on the date first set forth, to become effective as provided for in paragraph 3 hereof.

LANDLORD:

CITY OF LODI, a municipal corporation

By Thos. A. Peterson
THOMAS A. PETERSON
Its City Manager
Date: 2/22/93

TENANT:

NORTHERN CALIFORNIA POWER AGENCY

By James W Whalen
Its Assist Gen Mgr.
Date: January 29, 1993

ATTEST:

Jennifer M Perrin
JENNIFER M. PERRIN
City Clerk

Approved As To Form:

BJ McNatt
BOBBY W. McNATT
City Attorney

DESCRIPTION FOR LAND LEASE PURPOSES

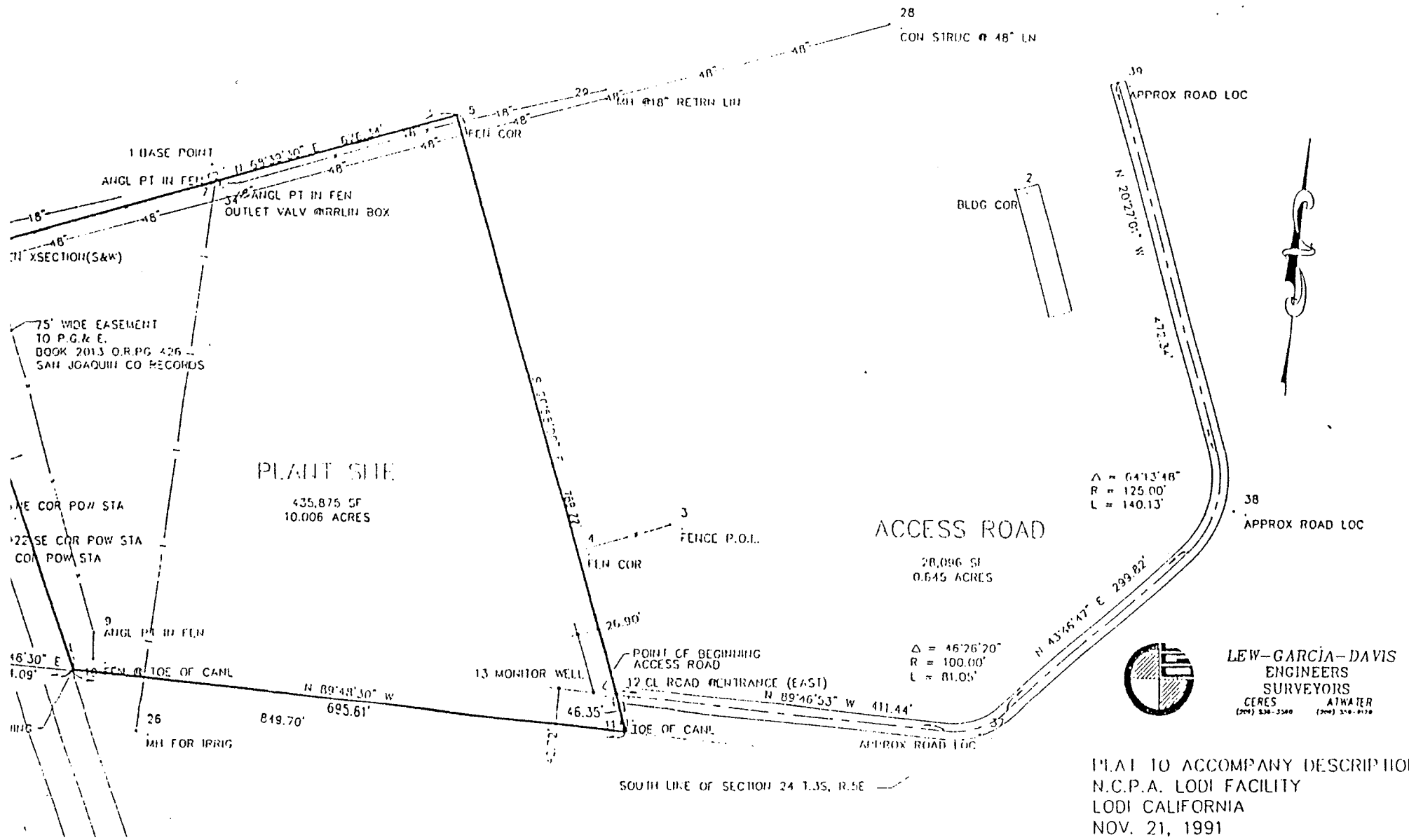
A portion of the southeast quarter of Section 23 and the southwest quarter of Section 24, Township 3 North, Range 5 East, Mount Diablo Base and Meridian, being more particularly described as follows:

COMMENCING at the southwest corner of said Section 24; thence South 89°48'30" East along the south line of said Section 24, a distance of 154.09 feet, more or less, to a point on the east line of that strip of land granted as an easement to the Pacific Gas and Electric Company described in Deed dated September, 6, 1957, in Book 2013 of Official Records at Page 426, San Joaquin County Records and the POINT OF BEGINNING of this description; thence North 23°56' West along said east line, a distance of 533.43 feet; thence North 68°39'30" East, parallel with and 20.00 feet south of the center of the south levee of the White Slough Water Pollution Control Plant Skimming Ponds, a distance of 676.34 feet; thence South 20°58" East, a distance of 788.22 feet to the south line of said Section 24; thence North 89°48'30" West along said south line, a distance of 695.61 feet, more or less, to the point of beginning.

Contains 10.0 acres, more or less.

Also, the centerline of a 20.00 foot wide easement being more particularly described as follows:

COMMENCING at the southwest corner of said Section 24; thence South 89°48'30" East along the south line of said section, a distance of 849.70 feet; thence North 20°58" West, a distance of 46.35 feet to a point on the center of a dirt access road and the POINT OF BEGINNING of this description, said point bears North 89°10'11" East, a distance of 28.66 feet from a monitoring well located in the southeast corner of above described land; thence South 89°46'53" East, a distance of 411.14 feet; thence along the arc of a curve concave to the north having a radius of 100.00 feet through a central angle of 46°26'20", a distance of 81.05 feet; thence




LEW–GARCIA–DAVIS
ENGINEERS
SURVEYORS
CERES (209) 538-3500 ATWATER (209) 358-9178

PLAT TO ACCOMPANY DESCRIPTION
N.C.P.A. LODI FACILITY
LODI CALIFORNIA
NOV. 21, 1991

room should be immediately adjacent to the boiler with a glass window (6 ft wide x 3 ft high). The operator should be able to view the unit simply by looking up from the control board. The Owner will require space for five 36 inch wide control panels at Ceres and *three* 36 inch wide control panels *(1-SCADA panel, 1-C/R panel, and 1- spare)* at Lodi. Phone system should include yard public address capability; Electrical Room (30 ft x 40 ft minimum dimensions) which will contain electrical switchgear, motor control centers, etc.; and the Turbine Area (Ceres Only) to house the turbine enclosure and the generator. All offices, lunch room, testing lab, electrical room, and tech shop shall be finished with vinyl floors, painted gypsum board walls and suspended acoustical ceilings. The restrooms and locker facilities shall be finished with ceramic floor tile, ceramic wall tile, and water resistant gypsum board ceilings. The lab countertop shall be black slate or stainless steel. All room finishes shall be in accordance with AIA standards and subject to approval by the Owner. All other areas not requiring finished surfaces shall have acoustical metal liner panel covering the insulation and building support steel. Acoustical insulation shall be used to prevent noise transmission to other areas.

3. Warehouse (30 ft x 60 ft minimum dimensions) for spare parts for the facility shall be included.

All pre-engineered buildings proposed shall be Star or Varco Pruden.

3.8.7 Site Fencing

The entire site shall be fenced with a eight foot high fence complete with extension arms with three rows of two-strand barbed wire projecting at an angle of approximately 45 deg extending outward. The fencing material shall be vinyl coated No. 9 gage good quality steel wire. The fabric shall have a uniform diamond mesh approximately 2 in between the parallel sides. Top and bottom selvages shall have a twisted and barbed finish.

The Contractor shall provide at the main entrance a motor-operated gate. The Contractor shall also provide an intercom system from the main gate to the control room and allow for remote operation of the main gate from the control room.

Fence posts, gates, and accessories, such as barbed and tension wire, ties, bands, clips, stretcher bars, post tops, post braces, and gate hinges, latches, stops, and keepers shall be in

Final Signed Copy
Feb. 11 14

# GROUND LEASE

by and between

THE CITY OF LODI

(Owner)

and

SAN JOAQUIN COUNTY MOSQUITO
AND VECTOR CONTROL DISTRICT

(Tenant)

GROUND LEASE

TABLE OF CONTENTS

# GROUND LEASE

THIS LEASE, entered into this first day of Febrauary, 1994, by and between the CITY OF LODI, a municipal corporation ("Owner"), and SAN JOAQUIN COUNTY MOSQUITO and VECTOR CONTROL DISTRICT ("Tenant").

1. Premises. Owner leases to Tenant and Tenant leases from Owner that real property in the City of Lodi, County of San Joaquin, California, described in Exhibit A attached hereto and made a part hereof. The premises leased to Tenant are referred to in this Lease as the "Leased Premises" (approximately 12 ± acres).

2. Use. Tenant shall have the use of the Leased premises for the purpose of the developing, construction, operation and maintenance of ponds for the purpose of rearing mosquito fish and incidental ancillary uses and for any other lawful purpose.

3. Term; Extension. The term of this Lease shall commence on February 1, 1994 ("Commencement Date"), and shall terminate, unless earlier terminated in accordance with the provision of this Lease, on a date twenty (20) years from the Commencement Date. Tenant's right to exclusive possession shall commence on the Commencement Date. Tenant shall have the right to extend the term of this lease on all the terms and conditions set forth herein for an additional period of twenty (20) years, to be exercised by written notice to Owner during the last year of the initial term of this Lease.

4. Rent.

(A) Annual Rent. During the term of this lease, Tenant shall pay annual rent in the amount of $ 2,700.00, in advance, on or before the anniversary of Commencement Date of each year for the following twelve (12) month period. Additionally, Tenant shall furnish weed and mosquito abatement services throughout the City's 1,040 acre site (ponds and ditches).

(B) Rental Adjustments. The rent shall not be adjusted for the first five (5) years of the term. The rent may be adjusted on the Commencement Date of the sixth (6th) year and each fifth (5th) year thereafter. Following an adjustment, the rent will remain fixed for five (5) years. Future rent shall be based on what the owner receives on the adjacent 218 acre agricultural lease. Tenant and Owner shall act in good faith and cooperate with one another in establishing any adjustment.

(C) Payments. All rent paid shall be in lawful money of the United States of America and shall be paid without deduction or offset, prior notice or demand, and at such place or places as may be designated from time to time by Owner.

5. Utilities. During the term of this Lease, Tenant agrees to pay all charges and expenses in connection with utility services and to protect Owner and the Leased Premises from all such charges and expenses.

6. Repairs and Maintenance.

(A) At all times during the term of this Lease, Tenant shall, at its cost and expense, maintain the Leased Premises and all improvements thereon in good order and repair and safe condition, including but not limited to, fences and roadways predominantly used by Tenant. Tenant shall keep Owner apprised of the volume and nature of truck traffic and official activities upon the premises.

(B) Owner shall not be obligated to make any changes, alterations, additions or repairs in, on or about the Leased Premises or any part hereof or any improvements installed thereon. Tenant waives all provisions of law that may impose a duty of repair on Owner.

(C) Tenant shall indemnify and save harmless Owner against all actions, claims and damages by reason of (1) Tenant's failure to perform the terms of this paragraph, or (2) Tenant's nonobservance or nonperformance of any law, ordinance or regulation aplicable to this leased premises, and any liability or duty to repair imposed by the laws of California, except that tenant shall be under no obligation under the lease for conditions or problems of or on the premises which existed prior to the commencement of this lease.

(D) Tenant agrees to construct a perimeter fence around the Leased Premises according to the specification shown on Exhibit "B" agreed or equal.

7. Mechanic's Liens.

(A) Covenant Against Liens and Claims. Tenant shall not allow or permit to be enforced against the Leased Premises or any part thereof, any mechanic's, materialmen's, contractor's or subcontractor's liens arising from any claim growing out of work of any construction, repair, restoration, operation, replacement or improvement, or any other claim or demand no matter how the same may arise. Tenant shall pay or cause to be paid all of said liens, claims or demands before any lawsuit is brought to enforce them against the Leased Premises. Tenant agrees to indemnify and hold the Owner and the Leased Premises free and harmless from all liability for any and all such liens, claims and demands, together with reasonable attorneys' fees and all costs and expenses incurred by Owner in connection therewith.

(B) Tenant's Right to Contest Liens. Notwithstanding anything to the contrary set forth above, if Tenant shall in good faith contest the validity of any such lien, claim or demand, then Tenant shall, at its expense, defend itself and Owner against the same and shall pay and satisfy any adverse judgment that may be rendered thereon before the enforcement thereof against Owner or the Leased Premises.

(C) Owner Paying Claims. In the event Tenant shall fail to pay and discharge or cause to be paid and discharged, when due and payable, any tax, assessment or other charge upon or in connection with the Leased Premises, or any lien or claim for labor or material employed or used or any claim for damages arising out of the construction, repair, restoration, replacement, maintenance and use of the Leased Premises and any improvements thereon, or any judgment on any contested lien or claim, or any insurance premium or expense in connection with the Leased Premises and improvements, or any other claim, charge or demand which Tenant has agreed to pay or cause to be paid under the terms of this Lease, and if Tenant, after ten (10) business days' written notice from Owner to do so shall fail to pay and discharge the same, or in the event Tenant contests such tax, assessment, claim or charge then Owner may, at his option, pay any such tax, assessment, insurance expenses, lien, claim, charge or demand, or settle or discharge any action therefor, or judgment thereon, and all costs, expenses and other sums incurred or paid by Owner in connection with any of the foregoing shall be paid by Tenant to Owner upon demand, together with interest thereon at Bank of America's prime rate from the date incurred or paid. Any default in such repayment by Tenant shall constitute a breach of the covenants and conditions of this Lease.

8. Insurance and Indemnity.

(A) Owner's Nonliability. Owner shall not be liable for any loss, damage or injury of any kind to any person or property arising from any use of the Leased Premises, or any part thereof, or caused by any defect in any building, structure or other improvement thereon or in any equipment or other facility therein, or caused by or arising from any act or omission of Tenant or any of its agents, employees, licensees or invitees, or by or from any accident on the Leased Premises or any fire or other casualty thereon, or occasioned by the failure of Tenant to maintain the Leased Premises and all improvements thereto in a safe condition, or arising from any other cause except where caused by the negligence of Owner, its agents or employees.

(B) Indemnification of Owner. Notwithstanding anything to the contrary contained in this Lease, and irrespective of any insurance carried by Tenant for the benefit of Owner under the terms of this Lease, Tenant agrees to protect, indemnity and hold the Owner and the Leased Premises harmless from any and all damages and liabilities at any time occasioned by or arising out of (1) any act, activity or omission of Tenant, or of anyone holding under Tenant, or (2) the occupancy or use of the Leased Premises or any part thereof, by or under Tenant, or (3) any state or condition of the

leased premises or any part thereof except that tenant shall be under no obligation to Owner for any state or condition of the leased premises which was in existence prior to the commencement of this lease.

(C) Liability Insurance. Tenant shall procure and maintain at all times during the term of this Lease, at its sole cost and expense, a policy or policies of commercial public liability insurance by the terms of which Owner and Tenant are named as insured and are indemnified against liability for damage or injury to property or person, including death, of any person entering upon or using the Leased Premises or any improvements thereon or any part thereof, with a combined single limit for bodily injury and property damage in an amount of not less than ONE MILLION DOLLARS ($1,000,000). Such public liability insurance policy or policies shall be stated to be primary and noncontributing with any insurance which may be carried by Owner and shall contain a provision that the Owner, although named as an insured shall nevertheless be entitled to recover under that policy for any loss, injury or damage to the Owner, its agents and employees or the property of such persons by reason of the negligence of Tenant. Tenant may at its option self-insure upon the foregoing terms.

(D) Certificate of Insurance. All policies of insurance procured and maintained by Tenant hereunder shall be issued by companies having not less than Best's A: Class X rating and shall be issued in the name of the Owner and Tenant for the mutual and joint benefit and protection of the parties. Executed copies of all insurance policies or a certificate thereof shall contain a provision that not less than thirty(30)days' written notice shall be given to Owner prior to the cancellation, reduction of coverage, expiration or any material change in any such policy. If Tenants elect to provide coverage through a Joint Powers Entity, Tenant shall provide proof satisfactory to the Owner of the financial stability of the Joint Powers Entity.

(E) Failure to Provide Insurance. If Tenant fails or refuses to procure or to maintain insurance as required by this Lease or fails or refuses to furnish Owner with required proof that the insurance has been procured and is in force and paid for, Owner shall have the right at Owner's election, upon ten (10) days advance written notice, to procure and maintain such insurance. The premiums paid by Owner shall be treated as added rent due from Tenant with interest at Bank of America prime rate, to be paid within thirty (30) days of demand. Owner shall give prompt notice of the payments of such premiums, stating the amounts paid and the names of the insurer or insurers.

(F) Waiver of Subrogation. The parties hereby release each other, and their respective representatives, from any claims for damage to any person or to the Premises and the improvements which may be located upon the Premises and to the fixtures, personal property, tenant's improvements and alterations of tenant in or on the Premises and the improvements which may be located upon the Premises that are caused by or result from risks insured against under any insurance policies carried by the parties hereto and in force at the time of any such damage. Each party hereto shall cause each insurance policy obtained by it to provide that the insurance company waives all right of recovery by way of subrogation against either party in connection with any

damage covered by any policy, provided obtaining such a waiver in each such policy is then available at a reasonable charge. Neither party hereto shall be liable to the other for any damage caused by fire or any of the risks insured against under any insurance policy required by this Lease.

9. Owner's Covenants.

(A) Water Supply. Owner shall make available to Tenant an adequate supply of unchlorinated secondary wastewater effluent or other suitable water(s) from the White Slough Water Pollution Control Facility for the purpose of rearing mosquito fish.

(B) Discharge of Domestic Wastewater. Owner shall upon payment by Tenant of applicable connection fees, accept Tenant's domestic wastewater (employee restroom waste) from the project into the White Slough Water Pollution Control Facility, if Tenant is desirous of this service.

10. Repair and Restoration. If during the term of this Lease any building or improvement on the Leased Premises or any part thereof shall be damaged or destroyed by fire or other casualty, Tenant may, at its sole cost and expense, repair or restore the same or may elect not to repair or restore. If Tenant elects not to repair or restore, this Lease shall terminate. Tenant waives the provisions of Civil Code Sections 1932(2) and 1933(4) with respect to any destruction of the Premises. Any monies received by Owner as compensation for damage or loss to improvements installed by Tenant on the Premises shall be paid to Tenant and are hereby assigned to Tenant.

11. Assignment and Subletting. Tenant may not encumber, assign, sublease or otherwise transfer this Lease, or any right or interest hereunder, or in or to any of the improvements constructed or installed on the Leased Premises, in whole or in part, without the prior written consent of Owner. Such consent shall not be withheld unreasonably.

12. Default. The occurrence of any one or more of the following events shall constitute a default under this Lease by Tenant:

(A) Failure to pay an installment of rent or other sum;

(B) Failure to pay any insurance premium, lien, claim, demand, judgment or other charge provided for in this Lease to be paid or caused to be paid by tenant at the time and in the manner as provided in this Lease;

(C) Failure to maintain the Leased Premises or cause the same to be maintained as provided for in this Lease;

(D) Abandonment of the Leased Premises after completion of construction for a continuous period of one hundred twenty (120) days; or

(E) Failure to perform or breach of any other covenant, condition or restriction provided for in this Lease.

13. Remedies in Event of Default. Upon any default of Tenant, and in the event the said default is due to the failure of Tenant to make the payment of any installment of rent or other sum when due, and in the event Tenant shall fail to remedy such default within ten (10) days after written notice to do so, or upon any other default by Tenant, and in the event that Tenant shall fail to remedy such other default within thirty (30) days after written notice from Tenant so to do specifying the nature of such default, or if such default cannot be cured within thirty (30) days, Tenant has not commenced corrective action and prosecuted the same to completion with due diligence, or in the event that the default is of such a nature that it cannot be cured by any action of Tenant, then and in any of these events, in addition to any other remedy Owner may have by operation of law, Owner shall have the right but not the obligation without any further demand or notice to reenter the Leased Premises and eject all persons from the Leased Premises, using due process of law, and immediately terminate Tenant's right to possession of the Premises, and repossess the same by summary proceedings or other appropriate action, and Owner shall thereupon be entitled to receive from Tenant all damages allowed by law.

14. Estoppel Certificates. Owner and Tenant shall, respectively, at any time and from time to time upon not less than ten (10) days' prior written request by the other, deliver to the requesting party an executed and acknowledged statement in writing certifying:

(A) That this Lease is unmodified and in full force and effect (or if there has been any modification(s) thereof that the same is in full force and effect as modified, and stating the nature of the modification or modification);

(B) That to its knowledge the requesting party is not in default under this Lease (or if any such default exists, the specific nature and extent thereof);

(C) The date to which rent and other charges have been paid in advance, if any; and

(D) Such other information pertaining to this Lease as may reasonably be requested.

Each certificate delivered pursuant to this paragraph may be relied on by any prospective purchaser or transferee of the Leased Premises or of Owner's or Tenant's interest hereunder or by any fee mortgagee of the Leased Premises or of Owner's or Tenant's interest hereunder or by any assignee of any such mortgagee.

15. Ownership of Improvements. Title to any buildings, improvements or fixtures which may be placed on the Premises by Tenant shall remain in Tenant. Owner agrees to subordinate all rights, if any, which Owner may have in any of such improvements to the rights of Tenant. Tenant may remove the improvements at any time during the term of this Lease. Any improvements remaining on the Premises after expiration or sooner termination of the Lease shall become the property of Owner.

16. Miscellaneous.

(A) Attorneys' Fees. In the event any action is brought by Owner to recover any rent due and unpaid hereunder or to recover possession of the Leased Premises, or in the event any action is brought by Owner or Tenant against the other to enforce or for the breach of any of the terms, covenants or conditions contained in this Lease, the prevailing party shall be entitled to recover reasonable attorneys' fees to be fixed by the Court, together with costs of suit therein incurred.

(B) Waiver. No waiver of any breach of any of the terms, covenants, agreements, restrictions or conditions of this Lease shall be construed as a waiver of any succeeding breach of the same or other covenants, agreements, restrictions and conditions hereof. No delay or omission of Owner to exercise any right or remedy shall be construed as a waiver of any such right or remedy or of any default by Tenant under this Lease. The various rights and remedies reserved to Owner herein including those not specifically described in this Lease shall be cumulative and, except as otherwise provided by California statutory law in force at the time of execution of this Lease, Owner may pursue any or all of such rights and remedies whether at the same time or otherwise.

(C) Holding Over. If Tenant shall hold over the Leased Premises after the expiration of the term hereof with the consent of Owner, either express or implied, such holding over shall be construed to be only a tenancy from month to month, subject to all the covenants, conditions and obligations hereof, and Tenant hereby agrees to pay to Owner one-twelfth the annual rental as provided in this Lease; provided, however, that nothing herein contained shall be construed to give Tenant any rights to so hold over and to continue in possession of the Leased Premises after the expiration of the term hereof.

(D) Surrender at End of Term. Upon the end of the term of this Lease, as provided herein, or any extension thereof, or sooner termination of this Lease, Tenant shall surrender the Leased Premises, together with all improvements as hereinabove provided. Upon surrender of the Premises, Tenant shall, if directed by the Public Works Director, remove at its own expense any and all equipment remaining thereon.

(E) Lease Binding Upon Successors and Assigns. Subject to the limitations on assignment and subleasing, each of the terms, covenants and conditions of this lease shall extend to and be binding on and inure to the benefit of not only Owner and Tenant, but each of their successors and assigns. Whenever in this Lease reference is made to either Owner or Tenant, the reference shall be deemed to include, wherever applicable, the successors and assigns and such parties the same as if in every case expressed.

(F) Inspection. Owner reserves the right for Owner and Owner's agents and representatives to enter upon the Leased Premises at any reasonable time for the purpose of attending to Owner's interest hereunder, and to inspect the Leased Premises.

(G) Relationship of Parties. The relationship of parties hereto is that of Owner and Tenant, and it is expressly understood and agreed that Owner does not in any way nor for any purpose become a partner or agent of Tenant or a joint venturer with Tenant in the conduct of Tenant's business or otherwise.

(H) Time of the Essence. Time is expressly declared to be of the essence of this Lease.

(I) Memorandum of Lease. This Lease shall not be recorded, but the parties agree to execute and deliver a Memorandum of this Lease in recordable form, which Memorandum shall be recorded.

(J) Quitclaim. At the expiration or earlier termination of this Lease, Tenant shall execute, acknowledge and deliver to Owner within five (5) days after written demand from Owner to Tenant any quitclaim deed or other document required by any reputable title company to remove the cloud of this Lease from the real property subject to this Lease.

(K) Number and Gender. Whenever the singular number is used in this Lease and when required by the context, the same shall include the plural, and the masculine gender shall include the feminine and neuter genders, and the word "person" shall include corporation, firm or association. If there is more than one Tenant, the obligations imposed under this Lease upon Tenant shall be joint and several.

(L) Headings and Titles. The marginal headings or titles to the paragraphs of this Lease are not a part of this Lease and shall have no effect upon the construction or interpretation of any part of this Lease.

(M) Entire Agreement. This Lease contains the entire agreement of the parties hereto with respect to the matters covered hereby, and no other previous agreement, statement or promise made by any party hereto which is not contained herein shall be binding or valid.

(N) Force Majeure. Except as to the payment of rent, neither of the parties hereto shall be chargeable with, liable for, or responsible to, the other for anything or in any amount for any delay caused by fire, earthquake, explosion, flood, hurricane, the elements, acts of God, or the public enemy, action or interference of governmental authorities or agents, war, invasion, insurrection, rebellion, riots, strikes, or lockouts or any other cause whether similar or dissimilar to the foregoing, which is beyond the control of such parties and any delay due to said causes or any of them shall not be deemed a breach of or default in the performances of this Lease.

(O) Disclaimer of Representation. Except as otherwise specifically provided herein, Owner has made no representations or warranties to the Tenant concerning the Leased Premises, the present use thereof or the suitability for Tenant's intended use of the property. The foregoing disclaimer includes, without limitation, topography, climate, air, water, water rights, utilities, present and future zoning, soil, subsoil, drainage, access to public roads, proposed routes of roads, or extension thereof, or effect of any state or federal environmental protection laws or regulations. Tenant represents and warrants to Owner that he and his representatives have made or will make their own independent inspection and investigation of the Leased Premises and Tenant, in entering into this Lease, is relying solely on such inspection and investigation. No patent or latent physical condition of Leased Premises, whether or not known or discovered, shall affect the rights of either party hereto. Any agreement, warranties or representations not expressly contained herein shall in no way bind either Tenant or Owner. Owner and Tenant waive any right or rescission and all claims for damages by reason of any statement, representations, warranty, promise and agreement, if any, not contained in this Lease.

(P) Quiet Enjoyment. This Lease is subject and junior only to all existing easements, covenants, conditions and restrictions and other matters and encumbrances of record as if the date of this Lease. As long as Tenant is not in default of any provision of this Lease, Tenant shall be entitled to quiet enjoyment of the premises.

(Q) Termination. Tenant may terminate this Lease at any time upon six (6) months advance notice.

17. Payments and Notices. Any notice to be given or other document to be delivered by either party to the other party may be given by personal delivery or may be deposited in the United States mail in the State of California, duly registered or certified, with postage prepaid, and addressed to the party for whom intended as follows:

| | |
|---|---|
| To Owner: | City of Lodi<br>Attn: City Manager<br>P.O. Box 3006<br>Lodi, CA 95241-1910<br>cc: Public Works Director |
| To Tenant: | San Joaquin County Mosquito<br>and Vector Control District<br>Attn: Manager<br>7759 South Airport Way<br>Stockton, CA 95206-3918 |

Either party hereto may from time to time by written notice to the other party designate a different address which shall be substituted for the one specified above. If any notice or other document is sent by registered or certified mail, as provided above, the same shall be deemed served or delivered seventy-two (72) hours after the mailing thereof.

18. Right of First Refusal. Owner shall not at any time during the term of this lease sell or convey or agree to sell or convey all or any portion of the Leased Premises without first having complied with the requirements of this Paragraph. Owner shall desire to sell or convey all or any portion or portions of the Leased Premises, Owner shall obtain from a third party a bona fide arms' length offer (the "Offer") and Owner shall submit a written copy of the Offer to Tenant and shall give Tenant forty-five (45) days within which to elect to meet the Offer. If Tenant elects to meet the Offer, Tenant shall give Owner written notice thereof and closing shall be held within forty-five (45) days thereafter, whereupon Owner shall convey to Tenant all or any portion of the Leased Premises which are the subject of the Offer. At closing, Owner shall deliver to Tenant a grant deed, sufficient to convey to Tenant fee simple title to the Leased Premises free and clear of all liens, restrictions and encumbrances. Owner shall pay all transfer taxes in connection with such conveyance This right of first refusal shall continue as to any and all portions of the Leased Premises. In the event Tenant shall elect not to meet any Offer, Owner may thereafter sell the portion or portions of the Leased Premises which are subject of the Offer only to the party who made the Offer and only strictly in accordance with the terms thereof. To prevent Owner from defeating the rights of Tenant hereunder, Owner agrees that Owner will at no time accept an offer to purchase all or any portion of the Leased Premises together with any other property of Owner in contravention of Tenant's right to purchase the Leased Premises.

19. Abandonment and Closure of Rearing Ponds. Upon termination of this lease, Tenant, at its sole expense, shall provide for the abandonment and closure of any and all rearing ponds utilized on site by Tenant to conform to adjacent surrounding ground. Such abandonment shall be done in compliance with all applicable state and federal laws and regulations.

This Ground Lease has been executed on the date first set forth, to become effective as provided for in paragraph 3 hereof.

OWNER:

CITY OF LODI, a municipal corporation

By Thos A. Peterson
THOMAS A. PETERSON

Title: City Manager

Date: January 19, 1994

TENANT:

SAN JOAQUIN COUNTY MOSQUITO and VECTOR CONTROL DISTRICT

By:
JOHN R STROH

Title:
MANAGER

Date: 1/23/94

ATTEST:

Jennifer M. Perrin
JENNIFER M. PERRIN
City Clerk

Approved As To Form:

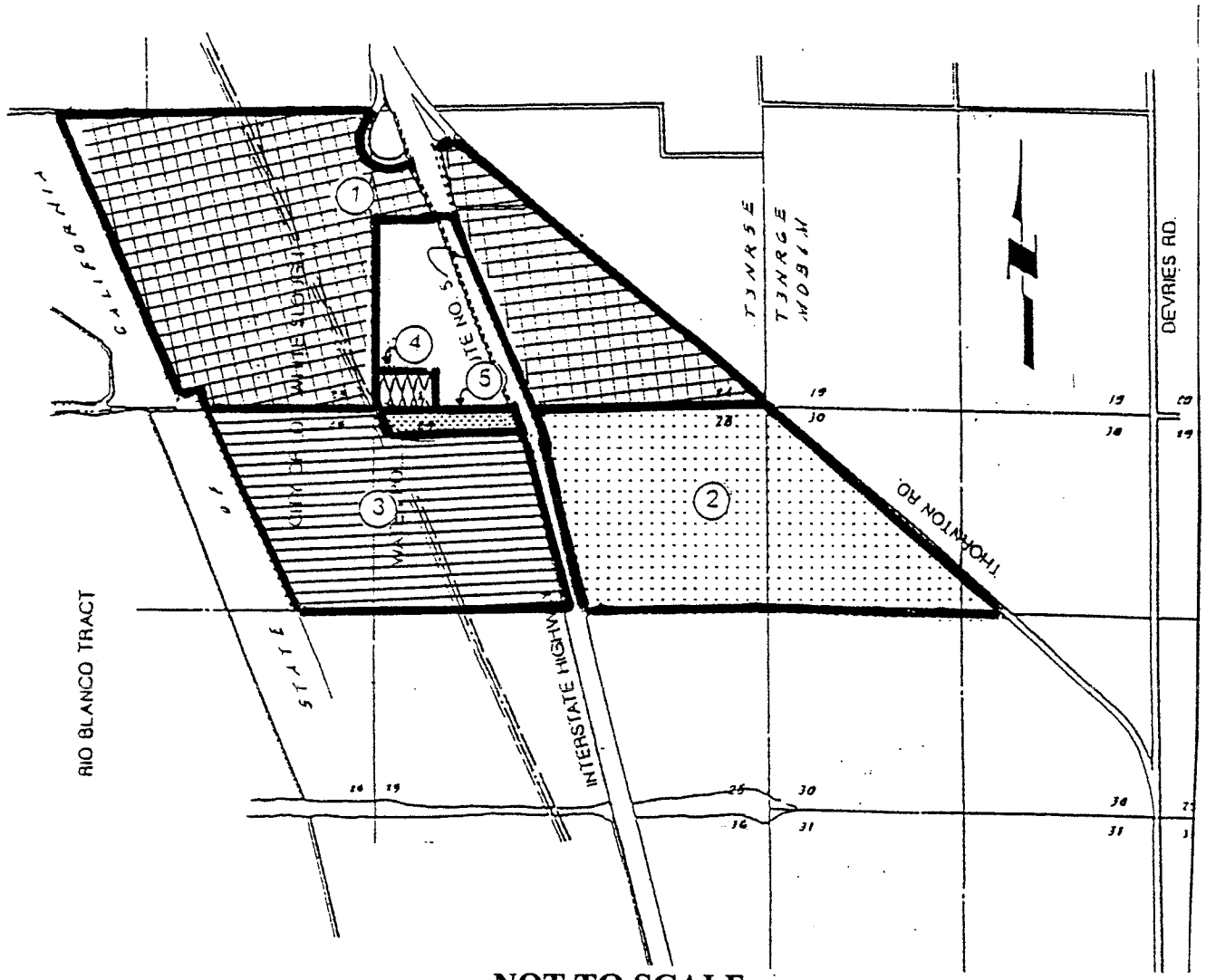
BW McNatt
BOBBY W. McNATT
City Attorney

# CITY OF LODI

PUBLIC WORKS DEPARTMENT

# EXHIBIT A

## WHITE SLOUGH WATER POLLUTION CONTROL FACILITY LAND LEASES




**NOT TO SCALE**

**LEGEND**

1. 389-acre parcel leased by Bechthold-Kirschenman Farms
2. 270-acre parcel leased by Bechthold-Kirschenman Farms
3. 218-acre parcel leased by Lima Ranch
4. 10-acre parcel leased by Northern California Power Agency
5. 12-acre parcel to be leased by San Joaquin County Mosquito & Vector Control District

EXHIBIT B

Site Fencing

The entire site shall be fenced with an eight (8) foot high fence complete with extension arms with three rows of two-strand barbed wire projecting at an angle of approximately 45 degree extending outward. The fencing material shall be vinyl coated No. 9 gage good quality steel wire. The fabric shall have a uniform diamond mesh approximately two (2) in between the parallel sides. Top and bottom salvages shall have a twisted and barbed finish.

Fence posts, gates, and accessories, such as barbed and tension wire, ties, bands, clips, stretcher bars, post tops, post braces, and gate hinges, latches, stops, and keepers shall be in accordance with Industrial Steel Specifications for Fence-Posts, Gates, and Accessories of the Chain Link Fence Manufacturers Institute except as follows:

- Intermediate posts shall be Type I or Type II round pipe.
- Posts shall have holes suitable for the through passage of a top fence rail.
- Bottom reinforcing wire shall be No. 7 gage galvanized steel wire.
- Double gates shall have eccentric double locking type latches which engage strikes securely bolted to the gate frames at both top and bottom, and also engage a heavy malleable iron nonfreezing gate stop anchored in a concrete footing at the center of the double gate opening. Latches shall be readily locked with a padlock.
- Hinges for swing gates shall allow gates to swing back parallel to the fence.